THE HEATING AND VENTILATING MAGAZINE

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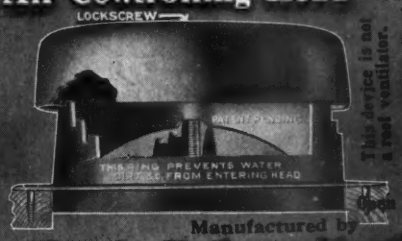

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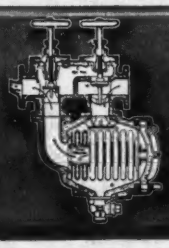

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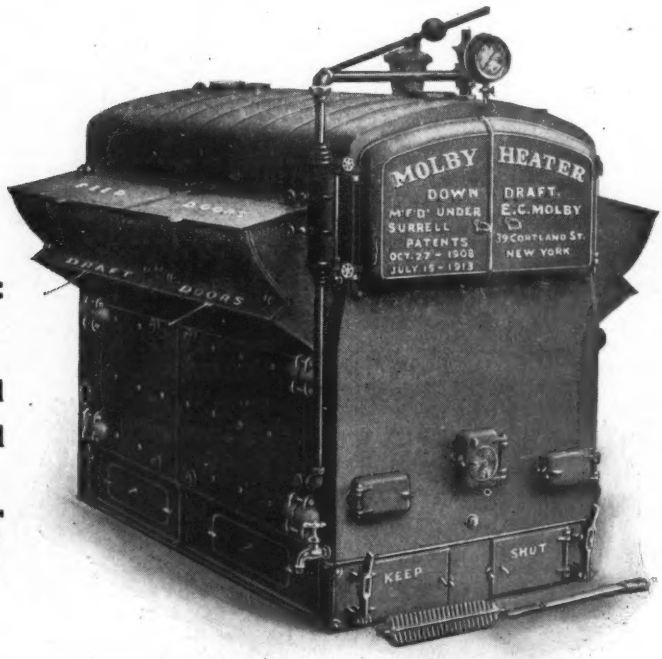

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THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK MAY, 1916

Passenger Car Steam Heating Plant at Atlantic City, N.J.

By CHARLES A. BINGAMAN,

Mechanical Engineer, Philadelphia and Reading Railway Co.

In conveying live steam over considerable distances, overhead steam lines are in nearly every case preferable to underground systems, since almost perfect insulation can be provided. This was demonstrated the past winter in one instance where the writer was obliged to install a shop heating supply line from a power house to a large car shop. This line was carried on poles, overhead, for a distance of about 500 ft., entirely exposed to the weather. During a sleet storm, the line was covered with a sheet of ice, and icicles 10 in. long were suspended from pipe covering for a period of two days, while line was passing steam at 100 lbs. pressure.

There are cases, however, where it is not possible to place steam lines overhead, and recourse must be had to one of several underground systems, as follows:

TYPES OF UNDERGROUND SYSTEMS.

(a) Steam line encased in tile pipe, underdrained.

(b) Steam line encased in cast-iron water pipe.

(c) Steam line encased in concrete ducts, underdrained.

(d) Steam line encased in wood box trunking.

(e) Steam line encased in wood stave pipe casings, providing insulation and waterproofing at same time.

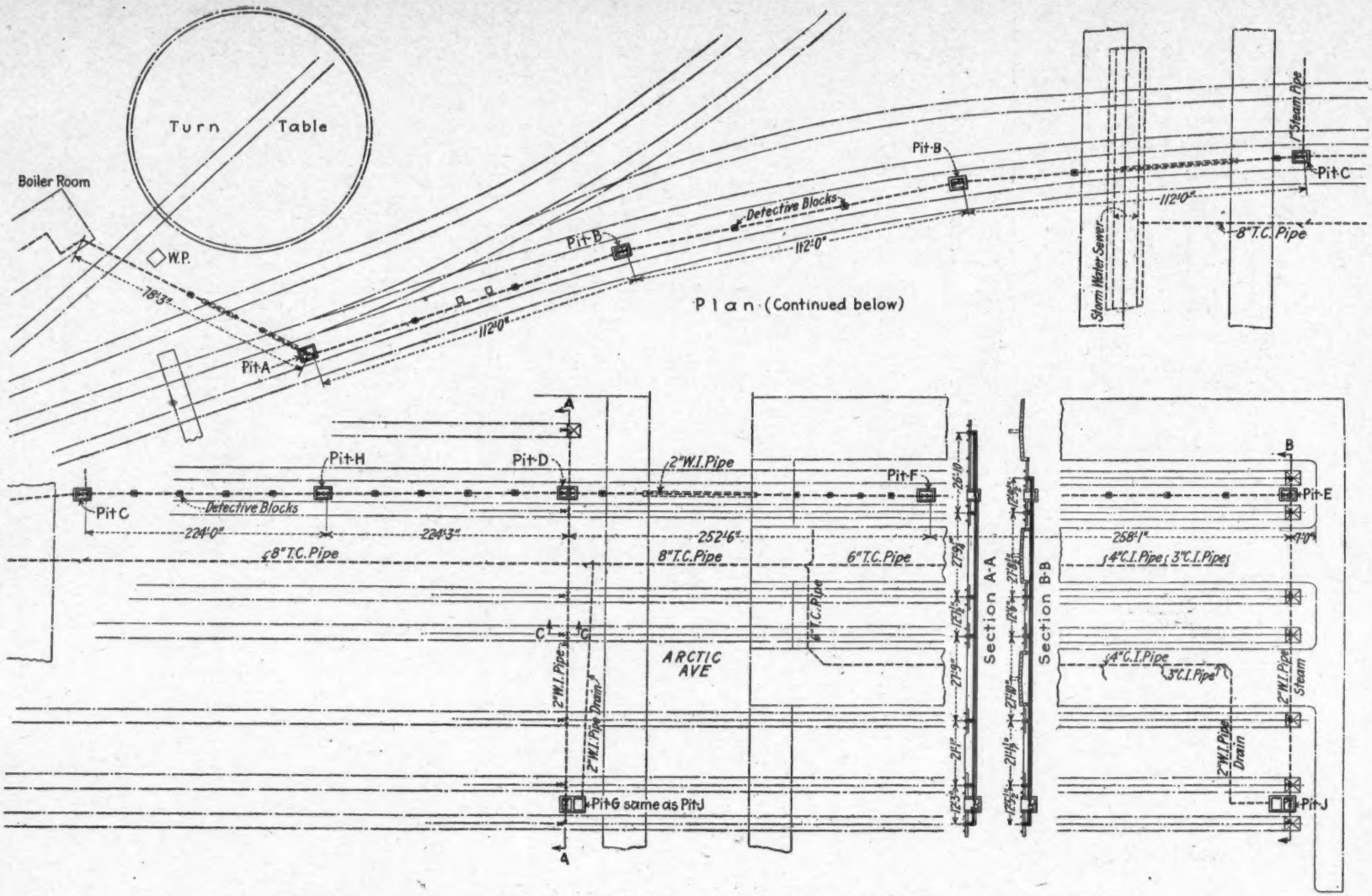
The selection of the best method of insulation for underground steam lines depends somewhat on the conditions to be met in each case and, in the writer's opinion, no so-called "best" method can be adopted on snap judgment for any case without danger of overlooking certain important features which may be peculiar to the proposed installation, and which may require special designs to cover same.

The least desirable methods, however, would seem to be those of encasing steam lines in ordinary wood box trunking or in cast-iron pipe; because, in the first case, a water-tight job cannot be obtained, and any insulation on pipe which might be used in connection with box trunking would not be effective when water-soaked; in the second case, there is the disadvantage of being unable to locate leaks in steam line, or to make repairs without a great deal of trouble and expense, to say nothing of delay in completing repairs and getting the line back into service.

THE PROBLEM AT ATLANTIC CITY.

The problem confronting the Atlantic City Railroad at its Atlantic City terminal, in providing a successful heating system for heating passenger cars standing at the station, was complicated by the following conditions:

1. The boiler plant was approximately 1,400 ft. beyond the station platform, at which cars were coupled to heating lines. Steam from the boiler plant passed to the heating lines through Foster steam pressure regulators. An overhead line could not be used on account of hav-



ARRANGEMENT OF PASSENGER CAR STEAM HEATING PLANT AT ATLANTIC CITY.

ing to cross a number of yard tracks and two city streets.

2. Yard tracks are laid on cinder fill, covering a sandy soil, and the underground steam line, which was finally decided upon, passed under several tracks, thence close to the ends of ties along one of the curved main tracks, it being found impossible to place the pipe line in the center between two running tracks, on account of switch target bases, etc.

3. It was necessary to adopt some form of insulation which was both heat-proof and water-proof, since during heavy rains the entire yard is covered with water to the top of the rails, and during storm tides has been covered with water to a depth of 14 ft.

It was also necessary to have insulation of such a character that it could be brought to the ground ready for rapid laying, without the necessity for cutting and fitting in the field, so as not to hold the pipe trench open for any great length of time, because of the danger of the caving in of tracks, due to heavy trains passing over tracks close to trench.

The above reasons made the use of an underdrained system of concrete ducts or tile ducts inadvisable, since concrete form work and seasoning of concrete would have required the trench to be open a considerable length of time, and the fact that the steam line was required to be laid at a shallow depth, due to obstructions in the form of water pipes. sewers, etc., in city streets, prohibited the use of tile casing, on account of danger of breakage, due to vibration of heavy trains and locomotives.

4. Special protection to insulation and steam lines was required, where the line crossed under yard tracks and under surface of city streets having heavy motor-truck traffic.

5. It was necessary to provide means for the detection of leaks in the steam line, and to arrange to make repairs to the line without great expense and delay.

WOOD PIPE CASING FOUND TO MEET REQUIREMENTS.

After consideration of a number of proposed installations, wood pipe casing, of the Standard Wood Pipe Company make, was finally decided upon as offering the best chances for success, and as meeting all the special requirements of the case. Best-grade white pine was decided upon as the material for the wood casing, since the alternate wet and dry ground conditions would be better resisted by white pine than by other woods.

DESCRIPTION OF INSTALLATION.

By noting the illustrations which are taken from working drawings a fair idea of the installation may be obtained.

All pipe and casing were necessarily laid in straight lines, provision being made at concrete expansion-joint pits for changes in the direction of the line, due to track curvature. No flanges were used on pipe passing through wood casing, all pipe being screwed together, using flanges only where attaching lines to expansion joints and anchorage fittings.

Steam pressure tests, at 80 lbs. to 100 lbs. per square inch, were made, testing every 40 ft. of line as made up and screwed on to the line, and before driving on the wood pipe casing.

Pipe guides, made in halves, of cast-iron were wired to the steam pipe, using two guides to each pipe length, to insure the steam line being centrally located in the bore of the wood pipe casing. Litharge and glycerin was used as pipe joint paste, to insure a tight, permanent job.

All ends of wood casing at the concrete pits were made to extend 2 in. beyond the inside face of the pit wall, and the wood casing was made with tapered chambered ends, to receive special cast-iron flanges driven into the wood casing ends and securely held in place by lag screws and wrought-iron keepers. These cast-iron flanges were designed to form a water seal for the wood casing and around the wrought-iron steam pipe, packing glands being provided with these flanges to provide for the free expansion of the steam lines.

It was found upon actual test under 80 lbs. steam pressure that ample expansion movement had been provided for, as noted on the plan of installation, at each expansion joint pit.

Detective blocks were introduced at regular intervals of 40 ft. to 60 ft. throughout the wood casing installation. these blocks being made in halves, cut on a horizontal center line, and secured together by ½-in. round iron bands, with nuts. A 1¼-in. gas pipe was screwed

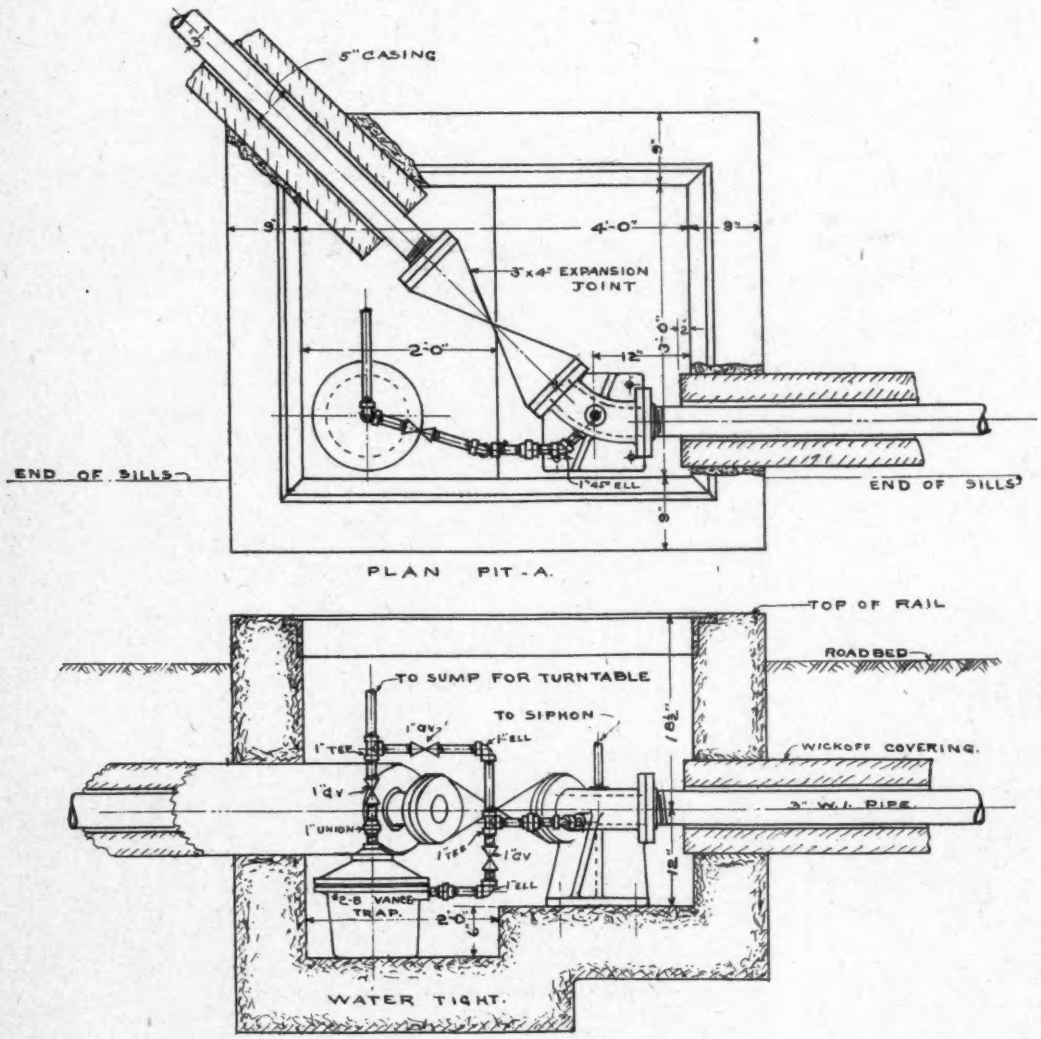
into the top half of the detective blocks, these pipes being extended to the surface of the ground, with a loosely-screwed pipe cap on the end of the pipe, by the removal of which the location of a leak in the steam line can easily be detected.

Detective blocks also make it possible to make repairs to the steam line more easily, since, by disconnecting the line at the expansion pits and removing a detective block, a section of pipe and casing can be removed and replaced without disturbing the remainder of the line.

Special provision was made at the top of the riser pipe casings to render same water-tight, by means of a running straight thread on the riser pipe, and the use of a screwed gland, with a taper fit into the chamber of the wood casing riser, this being screwed tight into the chamber, when the riser pipe was heated and expanded.

All drainage of steam lines was taken care of by means of automatic steam traps, arranging for gravity discharge from hot water sumps to sewer connections, so as not to have any possibility of steam pressure in the sewer lines.

When making up the wood casing at the factory, the lines were carefully laid out, as shown on the working plans, and each piece of piping or fitting casing was



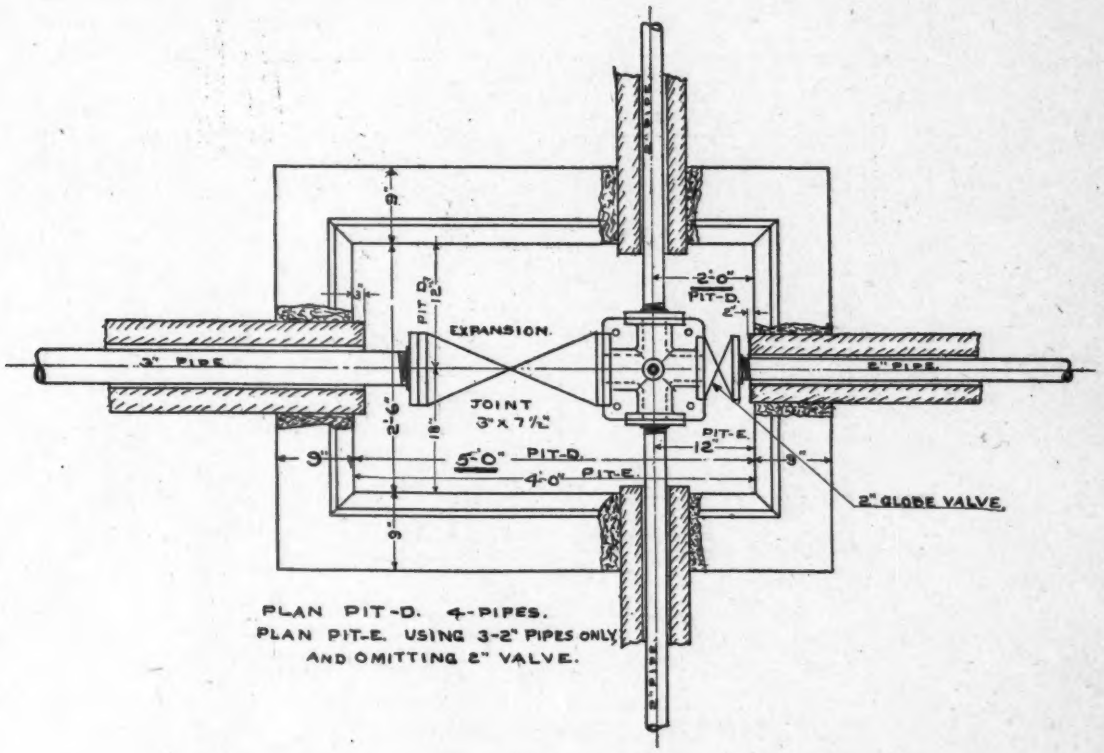
ARRANGEMENT OF PIT A.

tagged and numbered to agree with its position as shown on the drawing. The value of this was found when making the installation, since there was no confusion in assembling and placing the material, and the work was installed very rapidly, without any cutting and fitting in the field.

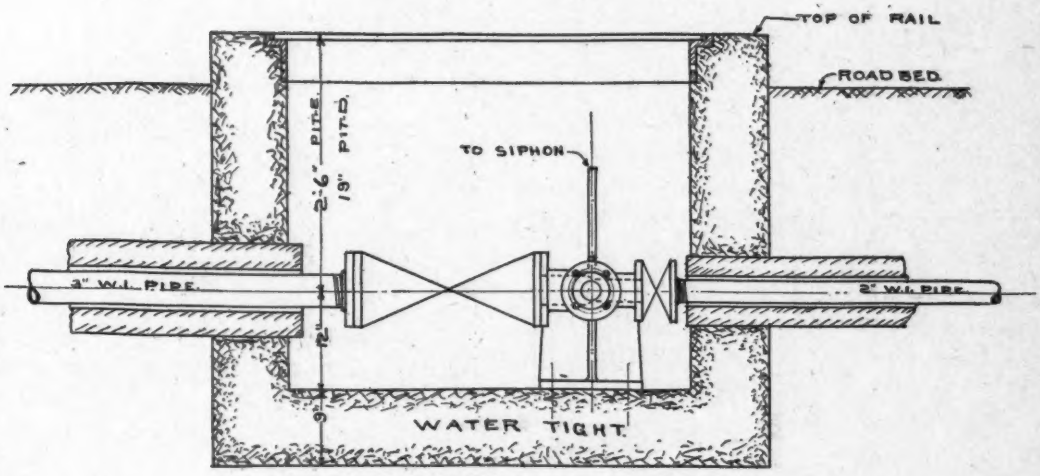
SPECIFICATIONS FOR THE WOOD CASING.

Since the specifications for the wood casing used in this installation may prove of some interest, a condensed form of same is given herewith, as follows:

(1) Wood casing to be made of good, sound, well-seasoned, white pine, in



PLAN PIT-D. 4-PIPES.
PLAN PIT-E. USING 3-2" PIPES ONLY AND OMITTING 2" VALVE.



SECTION OF PIT-D.
" " PIT-E, OMITTING 2" VALVE.
BLANK 3" END IN PIT-E.

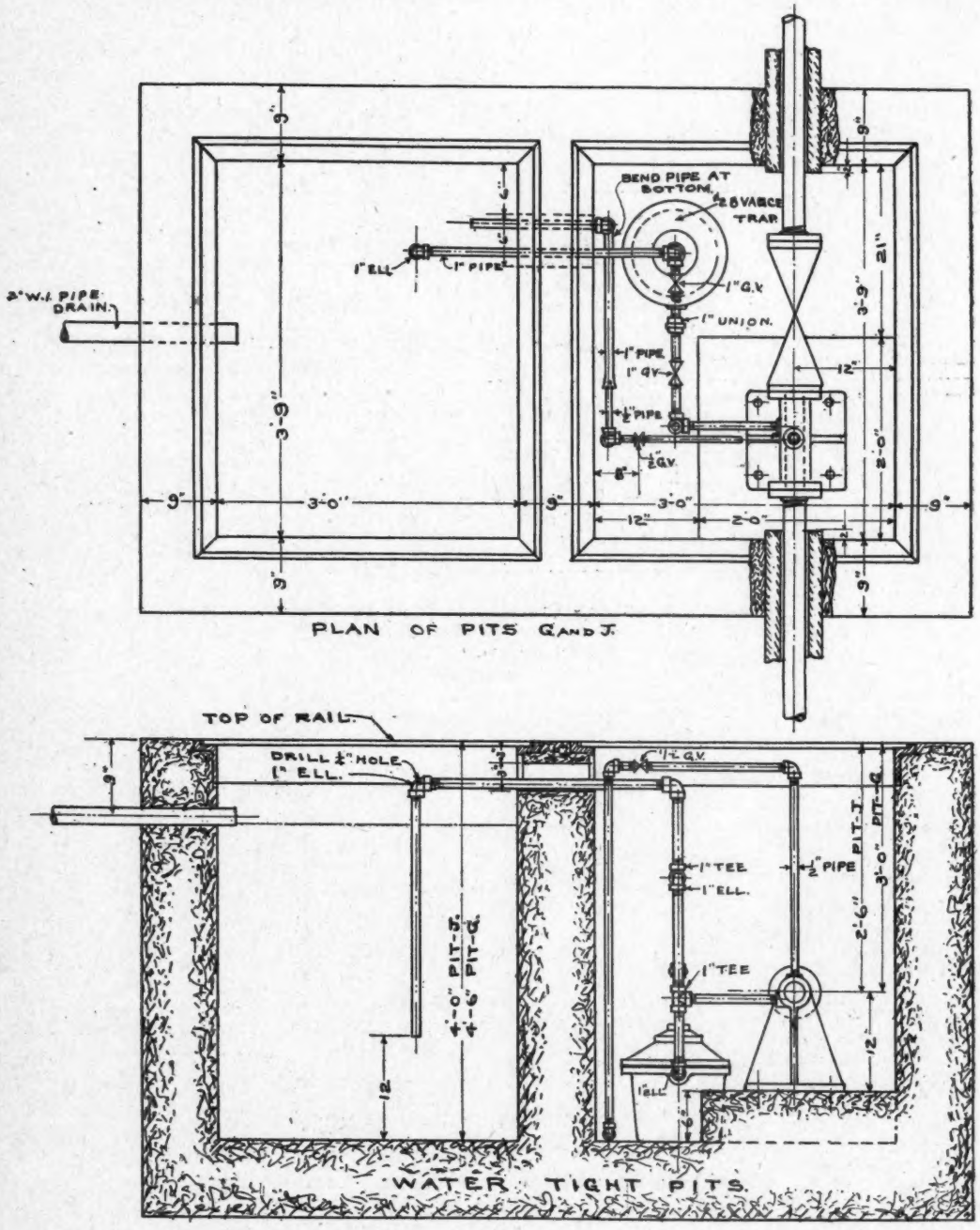
ARRANGEMENT OF PITS D AND E.

lengths of 12 ft., making such odd lengths as may be required to make up necessary line lengths to fit conditions shown on working plans.

(2) Casing to be lined with heavy tin, with clear bore dimensions of 5 in. for casing used on 3-in. w.i. pipe, and 4 in. for casing used on 2-in and 1½-in. pipe.

(3) Casing to be made of staves, having a uniform thickness of 4 in., planed on both sides to circle corresponding to outside and inside diameter of casing. Edges of staves to be radial, with beads left on one edge and grooves on the other edge, to fit staves together.

(4) Casing to be banded spirally with



ARRANGEMENT OF PITS G AND J.

heavy steel wire, wound under tension sufficient to cut wire into wood staves and insure tight casing. Spacing of wire spirals to be not over 4 in. and wire banding to be stapled to wood staves, using staple every 9 in. along wire, measuring on spiral along circumference of casing.

(5) Casing to have a waterproof coating of hot Hydrolene after wire banding is applied, and to be then rolled in sawdust, as a protecting coating.

(6) Chambers and tenons to be moderately tight drive fit, to insure tight joints when line is made up in trenches.

(7) All ends of casings projecting into concrete pits or ends of riser casings to have tapered chamber to received c. i. water seal flange glands. The tapered chamber ends of all casings to have a protecting tension band of ½ in. round iron, with nuts, to prevent opening of staves under gland pressure.

(8) Tee blocks, all blocks, and detective blocks to be made of blocks of well-seasoned white pine, free from knots. Blocks to be cut from square timbers, made in halves, tin lined, split on horizontal center line.

To be held together with ½-in. round iron bands, with nuts and special lugs, using a band at each end of block, which is to be turned circular to receive band.

Blocks to be not less than 3 in. thick at least dimension, and to be chambered or tenoned, as required, to make up lines as shown on working plans.

Blocks to be coated with hot Hydrolene and sawdust, as specified for regular pipe casing.

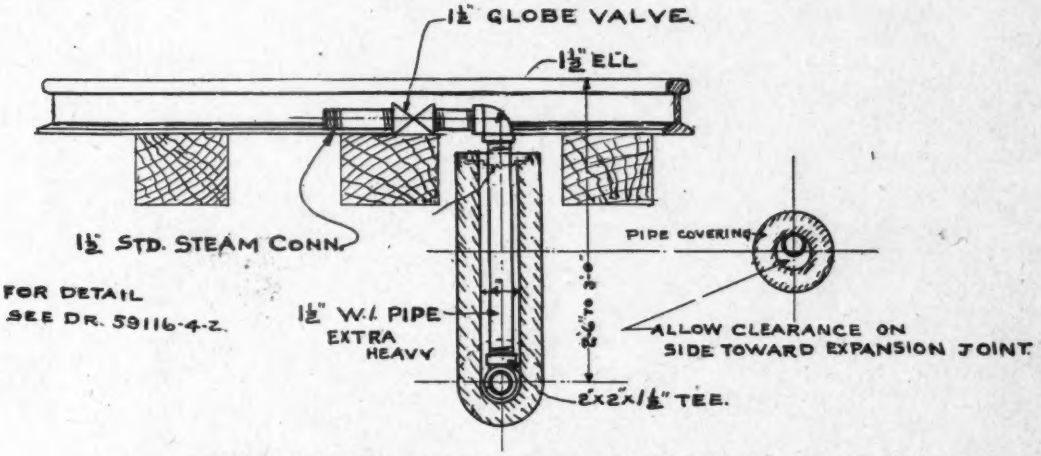
(9) All tenons or chambered ends to be treated with creosote at factory before shipment is made.

(10) Detailed statement of shipment, giving piece number, to accompany shipment of material, and each piece to be tagged, for identification with working plans, to facilitate work in field.

CONSTRUCTION OF EXPANSION PITS.

Regarding the concrete expansion pits, sump pits, etc., it should be noted that these pits were constructed of 1½-in. concrete with Trus-Con integral waterproofing.

Each pit was equipped with a steam siphon, with a controlling valve at the top of the pit, to drain same after heavy rains or high tides had subsided.



RISER SECTION ON C-C BETWEEN PITS D AND G.

RESULTS OF TEST OF LINE.

The actual test of this line showed the following results:

1. With 80 lbs. pressure entering the steam heating line at the boiler plant, and all outlets closed at the station platform end of the line, the drop in pressure between the two ends of the line was only 5 lbs.

2. With an outside temperature of 30° F. and wind about 12 miles per hour, 31 passenger cars were comfortably heated on the test run.

3. The line has at no time given any trouble, and steam condensation in line is at a minimum, as may be noted from the trap discharge at the sump wells.

This shows that the line is almost perfectly insulated, and that dry steam is delivered to the cars at the end of the system.

The line has now been in service for nearly three months and has given perfect satisfaction.

The work was designed and installed by the Motive Power Department of the Philadelphia & Reading Railway Company, under the supervision of Charles A. Bingaman, mechanical engineer.

Tests of a Magazine Steam Heater

By E. H. LOCKWOOD,

Assistant Professor of Mechanical Engineering, Sheffield Scientific School, Yale University.

Numerous fuel tests have been made at the Mason Laboratory of Mechanical Engineering as a part of the study of combustion in residence heating boilers, carried out under the general direction of Dr. L. P. Breckenridge, professor of mechanical engineering. In response to requests, the following brief summary is given of a portion of the work relating to magazine heaters.

DESCRIPTION OF THE HEATER TESTED.

The principal feature of the heater here referred to is a reservoir or magazine from which the fuel feeds down over the grates by gravity. The successful action of the furnace depends on the design of both the reservoir and the grates. in this heater* the grates are inclined like the sides of a flat letter A, placed symmetrically under the magazine, all arranged as shown in Fig. 1.

The fire is started on the grates, and notwithstanding the stored fuel above, the fire shows no tendency to enter the magazine. The gases pass through short tubes to the front, thence through tubes to the rear, providing effective heating surface.

The fuel best adapted to magazine feed is a small size anthracite coal, such as No. 1 buckwheat. The larger sizes, pea and chestnut, also broken coke, can be used in emergencies, but the small fuel is preferable on account of its cheapness and better feeding qualities.

FIRING PERIOD.

The entire contents of the magazine can be used up without any attention either to shake the grates or to spread the coal. The following table gives the principal data regarding the firing period of a small-size heater:

Maker's rating	700 sq. ft.
Water heating surface.....	123 sq. ft.
Grate surface, projected area.	4.7 sq. ft.
Magazine capacity at one firing, buckwheat coal.....	350 lbs.
Rate of combustion per hour at rating	20 lbs.
Firing period at rating.....	17.5 hrs.
Firing period at 150% rating.	11.5 hrs.

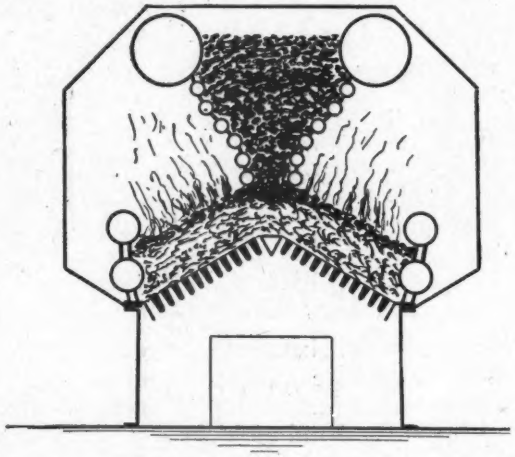


FIG. 1.—DESIGN OF HEATER USED IN TEST.

Numerous tests, made with coal bought in New Haven, have demonstrated that the fuel will feed over the entire grate surface, maintaining a steady fire without danger of burning out or clinkering for the periods indicated above. To secure these results it is necessary to clean the fire thoroughly with the magazine empty before firing new fuel. If the ashes are partially removed by simply shaking the grates with fuel in the magazine, the feed is liable to be interrupted by clinkers, requiring assistance to bring down fresh fuel from the magazine. It is necessary, therefore, for the attendant to learn the proper method of cleaning

*Made by the Spencer Heater Company, Scranton, Pa.

the fire to secure perfect feed over long periods.

ECONOMIC PERFORMANCE.

The boiler efficiency of the magazine heater just described is somewhat less than the efficiency found in flat-grate heaters of the best makes. This conclusion has not yet been confirmed by tests of other magazine heaters and possibly it may be true only of this particular unit. Our tests have shown uniformly a slightly lower efficiency, in spite of a boiler with ample heating surface, with a fire covering the whole grate all the time and a low flue temperature.

These facts indicate a lower furnace temperature and hence necessarily a lower efficiency. Clinkers are an index of high temperature, and their absence in the magazine furnace is a fair indication regarding temperature conditions. The loss of efficiency in the magazine heater may be considered as the price paid for the convenience of long-firing periods without attendance.

The foregoing paragraph gives an erroneous idea of the real efficiency of the magazine heater, considered from the standpoint of cost of producing heat. The loss of efficiency in burning coal, assuming this loss to exist, is offset many times over by the ability of the magazine heater to burn the small sizes of fuel, whose cost is approximately one-half that of the larger sizes. The magazine heater can, therefore, claim a good showing on two important points, convenience and economy.

BOILER RATING.

The boiler referred to in these tests was rated at 700 sq. ft., and this capacity was secured when burning only 4¼ lbs. of coal per square foot of grate area per hour. With good chimney draft it was possible to double this rate of combustion while the boiler efficiency remained

SAMPLE TEST OF MAGAZINE STEAM HEATER.

1.	Date of test	December 28, 1915
2.	Duration of test	26.15 hrs.
3.	Water heating surface	123 sq. ft.
4.	Grate area, projected	4.7 sq. ft.
5.	Kind of fuel	Yard pea, equivalent to No. 1 buckwheat
6.	Weight of coal fired (two firings)	693 lbs.
7.	Average firing period	13 hrs.
8	Ash and refuse in coal	15.4%
8a.	Ash in coal by analysis	9.87%
9.	Total weight of water fed to boiler	6080 lbs.
10.	Moisture in steam, by separator	0.4 of 1%
	Hourly Quantities.	
11.	Coal burned per square foot of grate per hour	5.47 lbs.
12.	Equivalent evaporation per hour from and at 212° F.	240 lbs.
	Pressures and Temperatures.	
13.	Average steam pressure by gauge	5.5 lbs.
14.	Average temperature of feed water	185° F.
15.	Average temperature of flue gases	265° F.
16.	Average draft	0.11 in.
	Capacity.	
17.	Makers' Rated capacity	700 sq. ft.
18.	Boiler capacity during test	960 sq. ft.
19.	Per cent. of rating developed	137
	Economic Results and Efficiency.	
20.	Water fed to boiler per pound coal as fired	8.78 lbs.
21.	Equivalent evaporation from and at 212° per hour per pound of dry coal	0.37 lbs.
22.	Calorific value of dry coal	13,800 B. T. U.
23.	Over-all efficiency, based on dry coal	66%

unchanged or even slightly better. If the rating of this boiler were increased 50% it would operate on a firing period of 12 hours with slightly increased economy of fuel.

The makers have erred in under-rating this magazine heater, being influenced perhaps by the practice of manufacturers of other types of heaters. Better results will be obtained by operating magazine heaters at higher rates of combustion, reducing first cost of installation, and, at the same time, increasing the fuel economy.

Test of Air Conditions in an Illinois School

WITH SUGGESTIONS FOR MAKING TESTS AND RECORDING RESULTS.

BY E. V. HILL, M. D.

Ventilating Inspector in Charge, Division of Ventilation, Chicago Department of Health

Requests are frequently received by the Ventilation Division of the Chicago Health Department for tests of air conditions in schools, not only in Chicago, but in towns and cities of the surrounding country. In many instances these requests arise from conditions that, it is apparent, are far from satisfactory. It not infrequently happens, however, that the request comes from a school recently built and equipped with the best modern ventilating appliances. In these cases it occasionally happens that considerable feeling is engendered between the engineers and the teachers in such schools. The engineer feels that the plant he has designed should give satisfactory air conditions and that there is no just cause for complaint. The school teacher, on the other hand, frequently complains of the extremely unsatisfactory air conditions in the class room even with the constant operation of the mechanical equipment.

This situation has brought mechanical ventilation, in schools particularly, into more or less disrepute and causes many persons to advocate window ventilation as the more desirable. I am satisfied from the tests and observations made by this department that the responsibility for this condition of affairs must be placed, in a large measure, on the engineers who design and superintend the installation of these mechanical equipments, not always on account of poor design or careless work, but because of improper testing and adjustment of the installation after its completion.

There is another class of cases that occasion considerable difficulty and complaint, I refer to instances where the type of occupancy of certain rooms, or the use to which they were to be put, was not clearly understood by the ventilating engineer when the equipment was laid out; for example, rooms intended for office purposes, where a comparatively small amount of air was introduced, are sometimes turned into class rooms with very

JOSEPH SEARS SCHOOL, KENILWORTH, ILL.

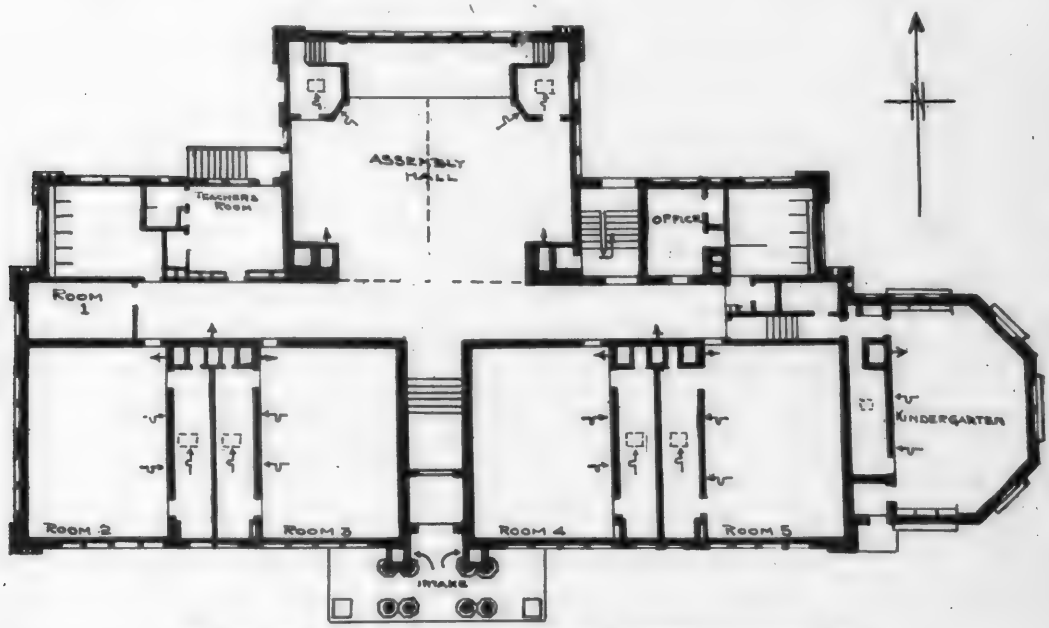
unsatisfactory results. These cases cannot be charged up to the engineer, but occasion considerable trouble.

WHY CLASS-ROOM VENTILATION IS OFTEN UNSATISFACTORY.

To properly ventilate a class-room requires an adequate air supply and the maintenance of a comfortable temperature. These two conditions are usually obtained and verified by tests, but to properly ventilate a class-room requires much more than this. It is essential that an air movement be maintained sufficient to remove the aerial envelope about the bodies of the occupants; a relative humidity of 35% to 50%, depending upon the temperature; a bacterial content not exceeding 10 colonies on a two-minute plate; a satisfactory CO_2 standard; a dust content not exceeding 100,000 particles per cubic centimeter as tested with the Aitken portable dust counter.

The air must also be free from odors and the distribution of the incoming air must be thorough and uniform. The room must also be free from objectionable drafts. The equipment should be so constructed that all parts of the ducts, fans, heaters, etc., are readily accessible for inspection and frequent cleaning. These additional requirements for the proper ventilation of a class-room are certainly of equal importance to the maintenance of an adequate air supply and a comfortable temperature, but they are not given proper consideration by the engineer in designing, and tests are not conducted after the installation of the apparatus to ascertain whether or not such requirements are being fulfilled. This is due to two causes: First, the average engineer does not have the necessary equipment and training for making the tests, and second, standards for these various requirements have not been heretofore definitely ascertained.

I believe it can be easily established that if the requirements just mentioned are met, either by a natural or mechanical system, there will be no complaints from the occupants regarding poor ventilation. Further, it is safe to assume that the air conditions will be productive of the best results from the standpoint of health. It is also evident that these requirements cannot be fulfilled by the use of windows in cold weather and a mechanical equipment must be used. It remains, therefore to see that the equipment meets, not two or three, but all of the requirements mentioned and that actual tests establish this fact. In making tests of this character during the past four years the department has never lost sight of the neces-



PLAN OF JOSEPH SEARS SCHOOL, KENILWORTH, ILL.

sity of establishing comparative standards, and while it is evident that many of these so-called standards must vary under varying conditions, and while it is also true that continued investigations may make it necessary to modify some of them, still the adoption of such standards has proven of considerable value in carrying on this work, especially in comparing the results obtained from different observations.

FEATURES OF SEARS SCHOOL TEST.

The following report of a test made in the Joseph Sears School of Kenilworth, Ill., is not given as an illustration of poor ventilation design, as the results obtained, with certain exceptions noted, are entirely satisfactory. It illustrates the method of testing school ventilation and also brings out the fact previously mentioned, that rooms occupied otherwise than originally intended give rise to serious complaint. It also shows results of tests in class-rooms ventilated by means of a good mechanical equipment as compared with those where window ventilation is employed:

The building is located on spacious grounds. It is a one-story and basement structure with a very pleasing architectural effect. All the class rooms, with the exception of one devoted to arts and crafts, are located on the main floor and have ample floor space and window area per occupant. The exception noted is situated over two-thirds below grade and the window area is deficient. This deficiency is more important than it would be in other parts of the building, owing to the fact that no air is supplied this room by the mechanical equipment.

It should also be noted that room No. 1, which evidently was originally designed as a store room, has been converted into a class room and occupied as a kindergarten at the present time. There is no mechanical air supply in this room and proper lighting and ventilation by the window cannot be secured.

The toilet facilities are ample for the building; the fixtures are comparatively modern and maintained at a high point of efficiency; the floors and general condition of cleanliness throughout the building, both with regard to construction and maintenance, are all that could be desired.

MECHANICAL EQUIPMENT.

With the exception of the toilet rooms, teachers' rooms and some others the building is heated and ventilated by a blast system. The air is brought in through intakes at the roof line, situated behind the columns at the entrance. The fan and tempering coils are located in the basement below the main entrance corridor. The tempering coils, consisting of three stacks of Vento heaters, with a by-pass damper beneath, are thermostatically controlled. The air is drawn through the coils into a double discharge, full-housed, belt-driven multivane fan, from which it is distributed to the various risers to the class rooms. The motor is 5 H.P., without speed control. In the upper portion of each riser is a re-heating coil thermostatically controlled from the room it supplies. The room is so designed that the air may be delivered at the floor line in warm or moderate weather without being re-heated. In cold weather the register at the floor line is closed and the one in the top of the riser opened so that the air is passed through the reheating coils before entering the room. The foul air from the class rooms is carried out beneath a space left between the blackboard and the floor in the cloak room and out through a ceiling grille by gravity.

No air washer is used in the equipment, but a humidifying device, consisting of perforated steam pipes provided with mufflers, is used. This humidifier is situated between the tempering coils and the fan inlet and is controlled by a humidostat located in the assembly room. The capacity of the fan at the speed operated is about 15,600 C.F.M. The boiler is a No. 12 Kewanee fire box of about 4,500 sq. ft. capacity.

SCOPE OF TESTS.

Investigations were made to determine the quantity, quality and distribution of air in the various class rooms. Anemometer readings were taken at the registers and checked by total air supply through the intakes. The distribution was determined by means of an ammonium-chloride test and also by samples of air taken and analyzed for carbon dioxide. Humidity and temperature observations were made and counts of bacterial

TEST-DATA
JOS. SEARS PUBLIC SCHOOL
KENILWORTH ILL.

Room	Seating Capacity	Number of Occupants at Time of Test	Air Supply C.F.M. Standard per Pupil	Air Supply C.F.M. per Seat	Air Supply C.F.M. per Occupant	Distribution	Carbon-Dioxide Standard Required	Carbon-Dioxide By Test	Temperature Fahr. Standard	Temperature Fahr. By Test	Rel. Humidity Standard	Rel. Humidity By Test	Cultures within Plates Standard	Cultures within Plates By Test
1	12	12	30	*7.5	*7.5	GOOD	9	12.2	69°	68°	40 to 60 depending on temp. see chart	42	12	22
2	50	21	"	35.	84.	"	"	5.2	68°	69°		40	"	13
3	50	16	"	35	110.	"	"	5.8	68°	68°		32	"	6.5
4	50	34	"	30.	44.	"	"	6.1	68°	70°		33	"	11.5
5	50	21	"	33.	77.		"	7.6	68°	70°		37	"	7.0
ARTS & CRAFTS	25	21	"	7.	*8.		"	11.5	68°	68°		38	"	22.
ASSEMBLY E	50	24	"	33.	82.	"	"	6.6	68°	68°		32	"	3.
" W	50	16	"	33.	112.		"	4.1	68°	68°		32	"	7.
KINDERGARTEN	50		"	36.					69°				"	
CORRIDOR			TOTAL 1960						65°				"	

AIR SUPPLY MEASURED AT INTAKE = 15,600 C.F.M.
" " " " SUPPLY REGISTERS = 14,340 C.F.M.
DISCREPANCY BETWEEN AIR MEASURED AT INTAKE AND TOTAL AMOUNT AT REGISTERS IS DUE TO AIR LEAKAGE.
AIR SUPPLY MARKED* ARE COMPUTED FROM CO_2 CONTENT.
CARBON-DIOXIDE CONTENT IN OUTSIDE AIR = 3.1

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colonies on two-minute Agar plates. These observations and tests were compared with standard conditions required in the best ventilation practice and conclusions drawn from the comparison.

Test data are tabulated under the heads of the various rooms, giving the number of occupants, air supply, distribution, CO_2 content, temperature, relative humidity and number of colonies developed on a two-minute plate. The columns under "CO_2"—"Temperature," "Relative Humidity" and "Cultures" are tabulated under two headings, the first being that of conditions that should obtain under best ventilation practice; the second the test data collected in the class rooms. In this way convenient comparisons can be made between standard conditions and those observed by test. Culture counts and carbon dioxide tests are averages from two or three observations made in each room. The east kindergarten room was unoccupied at the time of test, therefore no carbon dioxide samples or culture plates were made. Under "Air Supply" tabulations are made in three columns, giving the standard requirement per pupil in a given number; the air supply per seat by test and the air supply per occupant by test.

In those rooms where no air is supplied by the mechanical equipment a determination of air supply per pupil is made from the carbon dioxide determinations. (See foot note on test sheet.) The method of making these determinations is also shown on sheet No. 3, together with the formula used. The amount of air where the mechanical supply is used may also be checked in the same manner.

DISCUSSION OF TESTS.

A careful analysis of test data on above sheet shows conditions on the same much better than those maintained in the average public school building. It will be noted that in class rooms, 2, 3, 4 and 5, in assembly room east and west, and in the kindergarten the air supply exceeds that required by standard practice, with the exception of room No. 4, where it is exactly 30 cu. ft. per seat. The carbon dioxide content by test in all of these rooms is considerably lower than that required by standard practice, as are also the colony counts on two-minute Agar plates. The temperature in rooms 4 and 5 was only 2 degrees higher than good

practice dictates, and as the relative humidity was 33% and 37%, respectively, in these rooms the temperature and humidity conditions should be considered satisfactory.

It should be noted in this connection that a temperature of 68° F. in a class room should be accompanied by a relative humidity of 44%, or as near this point as can be maintained.

NOTE: There is a distinct relation between the temperature and humidity in their bearing on comfort. As the temperature goes down the humidity should increase, or vice versa, as the temperature increases the humidity should decrease in the proportion shown by the formula R=316—4T. This is well illustrated by the humidity chart, which was worked out by the Chicago Commission on Ventilation in their experimental room in the Chicago Normal College. (First published in THE HEATING AND VENTILATING MAGAZINE for October, 1914.)

Room No. 1, which is being used as a kindergarten at the present time was not originally designed for class room purposes. No air is supplied by the mechanical equipment and the amount obtained through leakage or the limited use of the window was only 25% of that required. The window was open slightly at the time of test.

It will be noted from test data that the CO_2 analysis was 12.2 parts in this room, and that the colonies on test plates average 22. Practically the same conditions prevail in the Arts and Crafts room, where the CO_2 analysis gave 11.5 and the cultures 22. These are the only two rooms where tests indicated conditions that should not prevail.

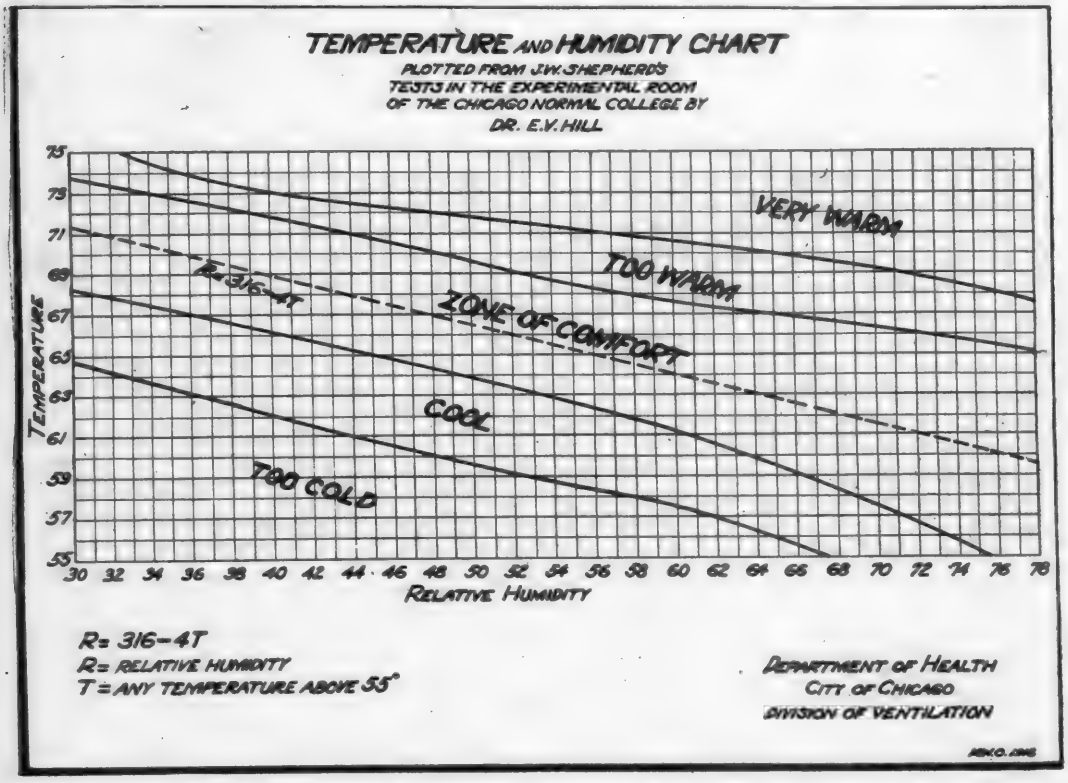
CONCLUSIONS.

The use of room No. 1 as a class room should be discontinued or a mechanical air supply provided. The same is true of the Arts and Crafts room in the basement. With the exception of these two rooms, the assembly room, the corridors and toilets are entirely satisfactory and considerably above the average conditions noted in public school buildings.

(The report was signed by E. V. Hill and Thomas R. Wilson.)

SUGGESTIONS FOR PLOTTING TEST RESULTS.

After making out the preceding report it became evident that some method was



(*Reprinted from* THE HEATING AND VENTILATING MAGAZINE, *for October*, 1914.)

CARBON DIOXIDE DETERMINATION IN VENTILATING PRACTICE FROM HILL'S FORMULA

FORMULA; $CO_2 = \frac{6000}{CFH\ PER\ OCCUPANT} + X$

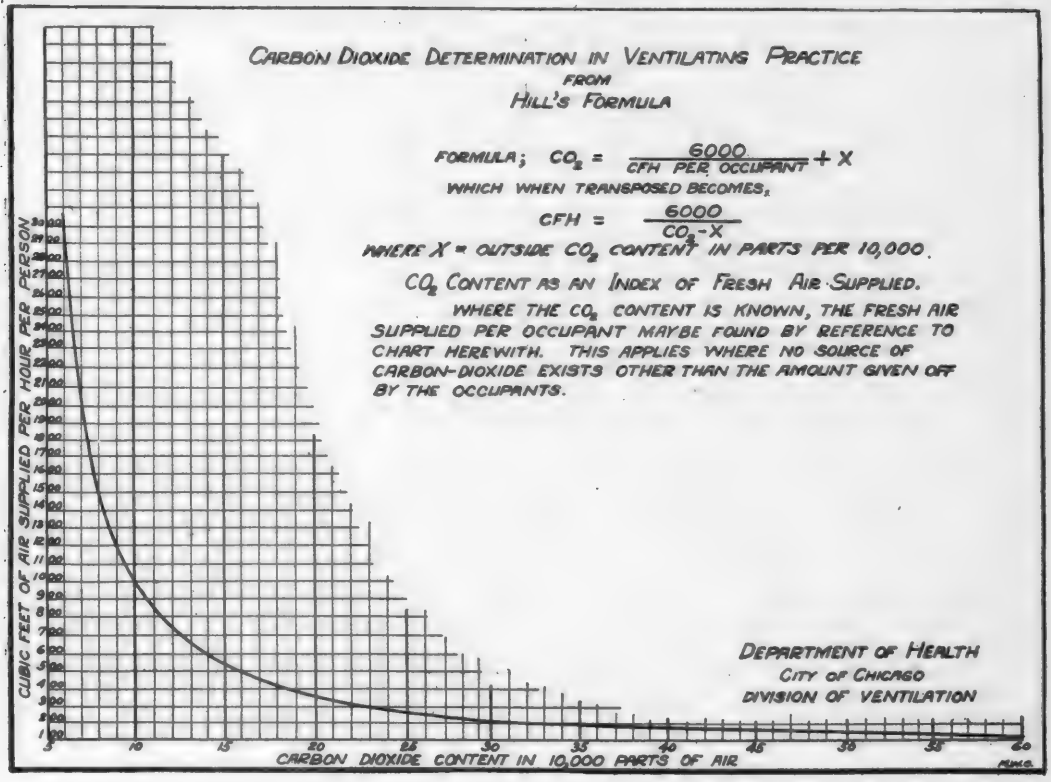
WHICH WHEN TRANSPOSED BECOMES,

$CFH = \frac{6000}{CO_2 - X}$

WHERE X = OUTSIDE CO_2 CONTENT IN PARTS PER 10,000.

CO_2 CONTENT AS AN INDEX OF FRESH AIR SUPPLIED.

WHERE THE CO_2 CONTENT IS KNOWN, THE FRESH AIR SUPPLIED PER OCCUPANT MAYBE FOUND BY REFERENCE TO CHART HEREWITH. THIS APPLIES WHERE NO SOURCE OF CARBON-DIOXIDE EXISTS OTHER THAN THE AMOUNT GIVEN OFF BY THE OCCUPANTS.



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RELATIVE HUMIDITY TABLE

DEGREES FAHR. BAROMETER 30" OF MERCURY

AIR TEMP. t	DEPRESSION OF WET BULB THERMOMETER $(t-t')$																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
30°	89	78	67	56	46	36	26	16	6																
35°	91	81	72	63	54	45	36	27	19	10	2														
40°	92	83	75	68	60	52	45	37	29	22	15	7	0												
45°	93	86	78	71	64	57	51	44	38	31	25	18	12	6											
50°	93	87	80	74	67	61	55	49	43	38	32	27	21	16	10	5	0								
55°	94	87	82	76	70	65	59	54	49	43	38	33	28	23	19	14	9	5	0						
60°	94	89	83	78	73	68	63	58	53	48	43	39	34	30	26	21	17	13	9	5	1				
65°	95	90	85	80	75	70	66	61	56	52	48	44	39	35	31	27	24	20	16	12	9	5	2		
70°	95	90	86	81	77	72	68	64	59	55	51	48	44	40	36	33	29	25	22	19	15	12	9	6	3
75°	96	91	86	82	78	74	70	66	62	58	54	51	47	44	40	37	34	30	27	24	21	18	15	12	9
80°	96	91	87	83	79	75	72	68	64	61	57	54	50	47	44	41	38	35	32	29	26	23	20	18	15
90°	96	93	89	85	81	78	74	71	68	65	61	58	55	52	49	47	44	41	39	36	34	31	29	26	24
100°	96	93	89	86	83	80	77	73	70	68	65	62	59	56	54	51	49	46	44	41	39	37	35	33	30

RELATIVE HUMIDITY

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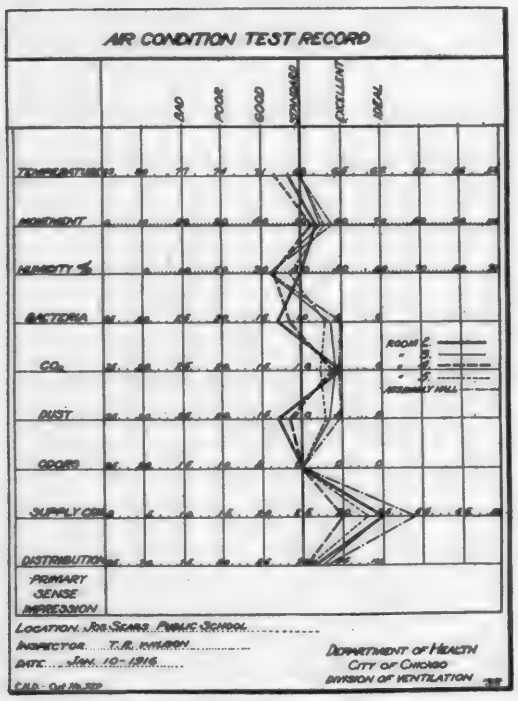
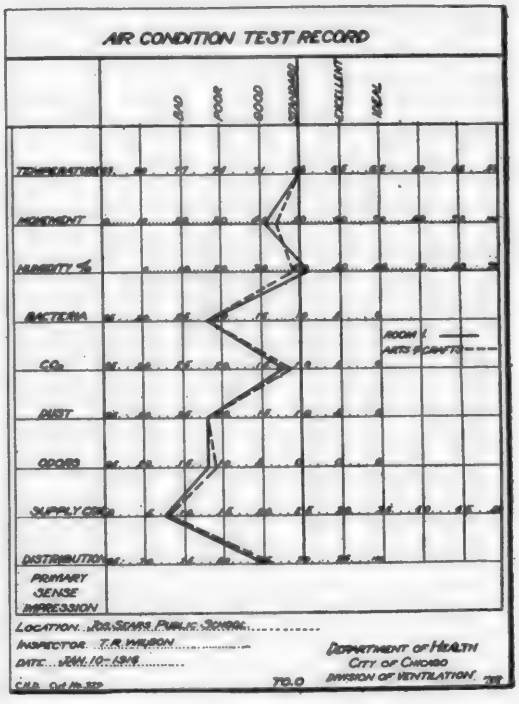




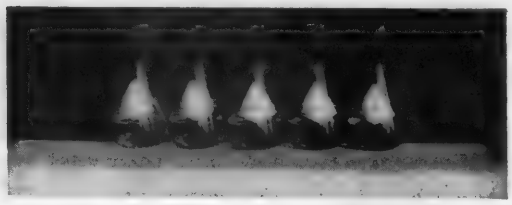
desirable whereby the results of tests in class rooms could be recorded or plotted in a method that would be easily understood. After some study the accompanying chart was devised and is now being used for work of this kind. It contains data covering all of the important air conditions essential for proper ventilation, graduated under six different headings: Bad, Poor, Good, Standard, Excellent. Ideal.

The standard requirements are those which can be maintained at a reasonable expense by a mechanical equipment during those seasons of the year when the windows must be closed. On the line "Excellent" will be found conditions somewhat superior to those designated ás "Standard." These conditions can be maintained by a mechanical equipment, although the expense would be considered by some excessive. The "Ideal" conditions could probably not be obtained by any mechanical ventilating device, as the entire elimination of dust and bacteria would be impossible. On the line marked "Good" conditions are found which obtain in the average class room. Under "Poor" and "Bad" the conditions are those that certainly should not be allowed to prevail.

A brief description of the methods used in making the necessary tests for filling out this chart may be of interest:

1.—*Temperatures*: Temperatures are determined by standard thermometers,

7-IN. SLING PSYCHROMETER.



SMALL ERLENMEYER FLASKS CONTAINING GRADUATED ODOR SOLUTIONS.

usually in four locations in a class room. Where extreme accuracy is not essential and dry bulb temperature, as indicated by the sling psychrometer, is used.

2.—*Air Movement*: The extent and velocity of the air movements in a room are determined by the use of a small ammonium-chloride apparatus, as shown in the illustration. It consists of two 100 c.c bottles, one containing hydrochloric acid and the other ammonium-hydroxide, carried in a leather anemometer case. By means of a rubber bulb and a suitable arrangement of tubing air is forced simultaneously through the two bottles and the fumes allowed to intermingle at the nozzle. In this way a cloud of ammonium-chloride is produced which is rather permanent and does not settle out of the air. Selecting a point where the direction of the air movement has been previously determined a small puff of smoke is produced and its velocity determined by means of a stop watch. With a little practice accurate results can be obtained.

3.—*Humidity*: For determining the relative humidity in ventilation work we have found the small 7-in. sling psychrometer, shown in the illustration, much more desirable than the larger models previously employed. The instrument is swung by a chain instead of a pivoted handle, as in the older model. It is compact, portable, and sufficiently accurate for this work.

DETERMINING VELOCITY OF AIR MOVEMENT USING AMMONIUM CHLORIDE APPARATUS.

TAKING AIR SAMPLE FOR CARBON DIOXIDE DETERMINATION.

4.—*Bacteria*: Various methods of determining the number of bacteria in a measured quantity of air have been discarded in practical test work for the simple method of exposing a standard Agar plate for two minutes. While considerable variation is observed under like conditions, still the average of four or five plates in a room is probably as accurate as the other methods.

5.—*Carbon Dioxide*: Air samples for dioxide are taken by means of the Paquelin cautery bulb and a 125 c.c. rubber stoppered bottle. The method is so well known that a description at this time would be superfluous.

6.—*Dust*: Dust determinations are made with the Aitken portable dust counter. Two methods are employed: First, the direct method in which precipitation of the particles is made directly on the object glass and counted before the condensation evaporates. Second, a smoked covered glass is placed in the machine and the precipitation made on this sur-

face. This method makes a permanent record which can be removed and counted with the aid of a microscope at leisure. It is somewhat more difficult to take observations by the second method, but it is more accurate, inasmuch as plenty of time can be taken in making the count.

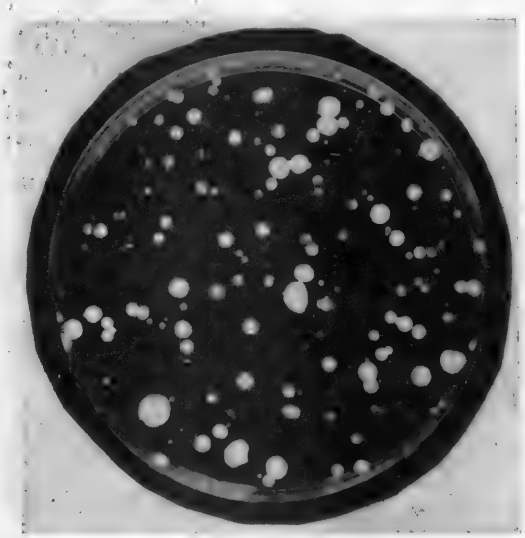
7.—*Odors*: As the individual element plays an important part in the determination of odors some experimental work has been done with the intention of standardizing this test. We have mixed in the form of a solution a large number of chemicals, such as hydrogen-sulphide, butyric acid and others, forming pronounced disagreeable odors, until we obtain a combination that gives a strong disagreeable odor, such as would be noticed under the worst possible conditions. This has been labeled "Strong." Various dilutions of this solution are made and labeled "Decided," "Distinct," "Noticeable" and "Very Faint," with their corresponding numbers on the chart. These various dilutions are used as standard odors and our inspectors are instructed to familiarize themselves with the same in order that their records of test may bear some similarity. This must be considered as a beginning only in attempting to standardize a difficult test.

8.—*Supply*: The air supply where a mechanical equipment is in use is determined by anemometer readings at the inlet openings. This is checked by computations from the average CO_2 analysis in the room.

EXPOSING AGAR PLATE FOR BACTERIA DETERMINATION.

9.—*Distribution*: The extent of distribution is worked out on a percentage basis. Referring to the chart, the standard conditions require 90% distribution, as it is evident that perfect distribution cannot be obtained. The percentage of distribution is determined by noting to

MAKING DUST COUNT WITH AITKIN MACHINE (DIRECT METHOD).



PHOTOGRAPH OF 5-MIN. AGAR PLATE CULTURE CONTAINING 221 COLONIES.

what extent the various CO_2 samples throughout the room vary from the average of all the samples. This variation is expressed in percentage.

A Character Study of the American Engineer

BASED ON THE OPINIONS OF 1400 MEMBERS OF ENGINEERING SOCIETIES.

The good and bad points of modern engineering education in the United States and their effects on the character and personality of the engineer, are brought out in the replies to nine questions which were received in response to a questionairre sent out by the Carnegie Foundation for the Advancement of Teaching. The questions were submitted to members of the national engineering societies and although the percentage of replies received is small, it is stated that they came from men who are successful engineers, have positions of authority and are experienced in employing engineering graduates.

Generally speaking, the replies showed that the schools are strongest in imparting technical knowledge and the scientific attitude and that they are weakest in imparting business sense, ability to apply theory to practice and power of expression. Of the factors making for success in engineering, the greatest emphasis was placed by the engineers replying upon character, self-reliance and independence and understanding of men.

Incidentally the following facts were mentioned as a basis for the opinions expressed in many of the replies. (The numbers in parenthesis indicate the number of times that the statement occurs.)

Engineers as a rule do not frame the policy for public improvements, but are hired as help (17); engineers seldom serve in the legislature or on public commissions (1). In engineering meetings ten per cent. of the members do the talking (2); engineering literature shows how engineers fail to convey their meaning (5); engineers cannot convince an audience (1). Only about half of the engineering graduates follow their specialty (8); there are not enough positions open to graduates of engineering colleges (2). Men trained in pure science make as successful engineers as those trained in engineering (2). Many mentally brilliant engineers have no greater earning power than carpenters' foremen (2); engineers take business courses in correspondence schools (1); few engineers arrive under the age of forty (1).

QUESTIONS 1, 2 AND 9.

What are the particular points at which the work of the engineering schools is effective and successful?

What are the particular points at which the work of the engineering schools is least effective and successful?

Make specific suggestions for the improvement and strengthening of engineering schools.

The answers to these questions showed generally that technical knowledge is effectively taught, that scientific thinking is also effectively taught and that the schools are successful in instilling ambition. As regards self-reliance, the general opinion was that the schools did not develop this attribute as much as they might, instances being enumerated where engineers had shown lack of decision and leadership, sense of authority, perseverance and responsibility.

The same opinion held true concerning industry, there being a tendency towards a lack of willingness to work, a lack of discipline and an aversion to buckling down to dirty work.

On the point of developing character, it was felt that this was not being accomplished with the desired degree of success, especially as regards personality and integrity. An adverse vote was also given on the point of efficiency, it being stated that too many failures were to be found on the points of good use of time, getting results, economy, short methods, concentration, executive ability, scientific management, system and order, and practical methods.

One of the striking results of the investigation was the decisive vote against the success of the schools in developing the physique of the students, including physical training and hygiene.

Other ways in which engineering

schools fail are in developing the engineering spirit and ideals, such as ideals of life, high purpose, professional ideals and understanding of ultimate aim of engineering.

The schools are deficient in the matter of legal and political training and in promoting the proper spirit of independence, such as initiative, resourcefulness, fairness, imagination, promptness, determination, decision and loyalty.

Humility is also insufficiently developed, too few taking the attitude of having more to learn and of beginning at the bottom. The schools fail to inculcate the necessary accuracy, including precision, detail, thoroughness and neatness.

Engineering judgment, it was stated, is frequently lacking in graduates who also are apt to show a lack of individual instruction in their college course, which would have been brought about by personal contact, vocational guidance, weeding out of the unfit and of not crowding the classes.

Ability to understand men is likewise insufficiently developed in engineering schools, this including ability to handle men, to judge character, to mix well and to develop tact and social address.

Graduates have not, as a rule, breadth of view, which would be obtained through general culture, general education, relation of engineering to other human activities and to a general perspective of life.

It was brought out emphatically that too few of the teachers are trained in practical work and are in constant touch with it. There are also too many subjects taught, too much useless information, too much detail, too systematic an arrangement of the curriculum, too many subjects chosen to please the professors rather than the students and too little cooperation among the departments.

Students are not taught sufficiently the power of expression, such as the use of English, the ability to express one's self in speech and writing and in public speaking.

Concerning the application of theory to practice it was felt that the schools failed in this respect also, such as ability to apply mathematics, solution of indeterminate problems, use of instruments and tools, practical experimental work, technique of engineering, knowledge of materials, shop methods, methods of construction and mechanical drawing.

Finally the schools do not impart as they should the business sense, including commercial address, bookkeeping, business principles, economics of engineering and business-like methods.

QUESTIONS 4, 5 AND 6.

What are the most important factors in determining probable success or failure in engineering?

When examining a candidate for a prospective job, what sort of information is best calculated to assist in judging his fitness and probable success? Give samples.

What sort of work, what specific jobs, what kind of experiences are most effective in testing a man for fitness and probable success in engineering? . Give samples.

These three questions are summarized together as far as the factors that make for success in engineering are concerned, because these factors were mentioned in the answers to all three. The following table contains the factors grouped about leading ideas arranged according to the number who mentioned them:

Character—Integrity and honesty and personality.

Self-reliance—Decision, responsibility, perseverance, persistence, grit, gumption, nerve, force, determination, enterprise, sand, firmness, endurance, ability to endure hardships, courage, loyalty, fidelity and reliability.

Ability to Understand Men.—To handle men, tact, unity and brotherhood, ability to co-operate, to judge men, to gain and keep the confidence of men, adaptability.

Engineering Spirit.—Ideals of engineering, natural bent, innate ability, capacity, aptitude, mechanical ability, temperament, imagination, foresight, aim—self or work.

Independence — Initiative, inventiveness, ingenuity, originality, creative ability, aggressiveness, push resourcefulness, "pep," versatility.

Judgment — Discernment, common sense, balance, perspective, proportion.

Industry—Energy, application, concentration, willingness to work, capacity for work, how to do dirty work.

Technical Knowledge—grasp of funda-

mentals, knowledge of theory, technical training, knowledge of subject.

Scientific Attitude—Logical thinking reasoning power, analysis, ability to face facts to observe, to profit by failure, optimism, openmindedness, disinterestedness, studiousness.

Accuracy—Precision, care for detail, thoroughness, neatness.

Efficiency—Executive ability, promptness, speed, system and order, methods of work.

Business Sense—Commercial training, knowledge of business, value of money, how to market his services.

Breadth of View—General education.

Ambition—Enthusiasm, interest, alertness.

Power of Expression—Ability to convince, to converse well.

Humility—Willingness to start at the bottom, patience, conscientiousness, sincerity, obedience, morality, religion, self control, lack of big head.

Application of Theory to Practice.

Physique—Physical health.

Luck in Striking Right Job—Opportunity, influential family and friends.

Same as in Other Work.

Memory.

The following is a list of the replies to question 5 as to the sort of information best calculated to assist in judging fitness and probable success in engineering, arranged according to the times mentioned:

Experience, record of experience, success in previous work, rate of promotion; personal impression, general appearance, address, quick wit, ability in presenting his case, conversational ability; previous training, schooling, college record, preparation; personal interests, personal habits, associates, boyhood experiences, spend spare time, outside reading; opinions of others on character, on work, references; aim—self or work, money or use, common welfare, attitude towards service; length of service, reasons for leaving jobs; family history; ability to pass examination on requirements; opinion of self and his own work; did he work his way through school?—finances; understanding by employer of what sort of characteristics are needed.

In answering Question 6 most of those replying suggested as the thing most effective in testing a man's fitness and probable success, any work requiring one or more of the factors of success summarized under Question 4. In addition, other specific suggestions were: Emergency work, trouble work, correcting others' failures, solving of problems not clearly stated, correcting incomplete drawings, writing a report that carries conviction, analysis of unfamiliar problems, special task in his specialty, apprentice work, running test on machines, making inventory of bill of material, search for data or needed information, speaking before an audience.

QUESTION 7.

Have you ever found a knowledge of either French, German or Spanish essential to your professional career?

Most of the answers received were in the negative. Of the balance, the knowledge of foreign languages was favored in the following order: Spanish, German, French, both French and German and Italian.

QUESTION 8.

Should a reading knowledge of one of the modern languages be required of every engineer? Why?

About half of those who replied thought that at least one foreign language should be required in the engineering schools, for the reason that it develops culture and breadth of view. The other half stated that the returns to students are not at all commensurate with the time spent.

Central Station Heating in Wadena, Minn.

DATA OF A SMALL PLANT THAT IS EARNING AT THE RATE OF 12.8% PER ANNUM

By L. A. LARSEN.

The recently-installed central heating plant in Wadena, Minn., consists of 980 ft. of 8-in. and 260 ft. of 6-in. steam mains with 3-in. return for the first and 2-in. return for the 6-in. mains. This system has 14,000 sq. ft. of radiation connected with piping equivalent to about 5,000 sq. ft. more, making a total of about 19,000 sq. ft.

On this system we are carrying from 3 to 5 in. of vacuum in the steam mains and from 11 to 14 in. in the return pipes. The efficiency of this plant can best be judged by the following figures taken from a test of a week's duration on the power plant:

Average boiler horse power per hour	78.5 B.H.P.
Average kilowatt-hour output	31.5 K.W.H.
Average daylight load from 6 A. M. to 4:30 P. M.	27 K.W.H.
Average water evaporated in boilers for K.W.H. output	71.2 lbs.

Whenever the load on the engine reached 110 amperes, 250 volts, no live steam was used to heat the system when the outside temperature was 10° F. below zero. This shows that 64.1 B.H.P. was sufficient to supply the system at the outset temperature mentioned.

Following is a statement of business of the company operating this plant, made on June 21, 1915. The company commenced operating the plant about December 10, 1914:

LIABILITIES.

Capital stock, fully paid at par.	$10,000.00
Bills payable	1,300.00
Milwaukee Conduit and Insulation Co.	125.00
Revenue received from operating plant	1,962.29
Total	$13,387.29

ASSETS.

Balance in Merchants' National Bank	$66.62
Plant at cost	12,236.93
Supplies on hand	187.47
Expense of operating plant	896.27
Total	$13,387.29

Revenue	$ 1,962.29
Less expense	896.27
Net revenue	$ 1,066.02

The heating season for the winter of 1914-1915 at Wadena was approximately 57% of a full season, based upon the following facts. Prior to January 12, 1915, only 3,350 sq. ft. of radiation was connected. Between January 12 and February 12 the balance of the radiation was connected, there being a total, as stated, of about 14,000 sq. ft.

Based on the Wadena Heating Company's statement to its stockholders, shown above, the plant, even in this short season, produced a net revenue of $1,066.02, which equals 8.71% on the investment. The item of operating expense includes a steam fitting bill of approximately $100 for cleaning traps, etc., which would probably have been no greater for a full season.

Had the Wadena Heating Company been in operation for a full heating season its gross revenue would have been increased 43%, or to $2,806.07. The operating expenses, minus the $100 steam fitting bill, would have been increased by 43%, or ($896.27—$100) x 43%=$342.40. $342.40+$896.27=$1,238.67. The company's net revenue would then have been $1,568.40, which equals 12.8% on the investment.

The rate to consumers in Wadena is 45 cents per 1,000 lbs. of steam condensation and the above-mentioned results were derived from this rate. Had the company had a sliding scale of rates to consumers in which the average rate would have been 64 cents per 1,000 lbs. of condensation, as it should have been, the company would have received 19 cents per 1,000 lbs. more revenue, or 42.2% increase in revenue, without any increase in operating expenses. The results for the partial season, as given in the statement, would then have been:

Gross revenue	$2,790.37

Operating expense	896.27
Net profit	$1,894.10

This is equivalent to 15% on the investment.

Again, had the company's plant operated for the full heating season at such an advanced rate, its gross revenue, based on the foregoing facts, would have been $3,991.65. The operating expense would have been, as before, $1,238.67 and the results would then have been:

Gross revenue	$3,991.65
Operating expense	1,238.57
Net revenue	$2,752.98

or 22.5% on the investment.

It will be of interest to add that the insulation used is 1-in. asbestos expanded covering, with 3-ply Gilsonite roofing felt jacket in the Milwaukee Conduit and Insulation Company's vitrified salt-glazed conduit, laid on an average of 5 ft. below the surface.

Cost of Removing and Replacing Pavements Incident to the Installing of Heating Lines in City Streets

BY W. F. VERNER.

Presented at the annual meeting of the American Society of Heating and Ventilating Engineers, New York, January 18-20,1916.)

One of the principal factors to be considered in constructing a distribution system for heating relates to the tearing up of the pavements in the city streets, and replacing the same in good condition. In most cities permission must first be granted before construction is begun, and in many cities it is customary for the municipality to do all repairing relative to the streets, and bill the company installing the system for the labor and material expense, incident to the repaving over the mains and services.

The manner pursued in constructing the system plays an important part. The customers must first be secured before extending a line, and after a period of years it is found that the total cost of construction is more than if the system had all been put in at once. That is, the work is done piecemeal. The cost of removing and replacing the pavement per square yard is necessarily higher than what a contractor would charge if he were paving an entire street. The following tables are the results of an extended study of actual costs.

The gangs doing this work generally consist of 6 men and a foreman; laborers, $2.50 per day; foreman, $3.60 per day of 9 hours. Distributing the foreman's time to each laborer will make a

TABLE 2—COST TO REMOVE VARIOUS KINDS OF PAVEMENT PER LINEAL FOOT OF TRENCH.

Width of Trench, Inches	Sheet Asphalt on 6" Concrete	Brick on 6" Concrete	Cedar Block on 6" Concrete	Cedar Block on Sand	Concrete 6"	Creosoted Block on 6" Concrete	Granite Block on 6" Concrete	Cobblestone on Sand
22	$0.09	$0.09	$0.06	$0.03	$0.03	$0.07	$0.10	$0.03
23	.09	.09	0.7	.03	.04	.07	.11	.03
24	.10	.10	.07	.03	.04	.07	.11	.03
25	.10	.10	.07	.03	.04	.08	.11	.03
26	.10	.10	.08	.04	.04	.08	.12	.03
27	.11	.10	.08	.04	.04	.08	.12	.03
28	.11	.11	.08	.04	.04	.09	.12	.03
29	.12	.11	.08	.04	.05	.09	.13	.04
30	.12	.11	.08	.04	.05	.09	.13	.04
31	.12	.12	.09	.04	.05	.09	.13	.04
35	.14	.13	.10	.04	.05	.10	.14	.04
36	.14	.13	.10	.04	.06	.10	.15	.04
37	.14	.13	.10	.05	.06	.11	.15	.04
39	.14	.14	.11	.05	.06	.12	.16	.05
41	.15	.15	.11	.05	.06	.12	.16	.05

charge of $3.10 for the work accomplished by each laborer.

TABLE 1

	Square yards removed for day of nine hours per man.	Cost per sq. yd. for removing.
Sheet Asphalt	13.05	$0.24
Brick	16.83	0.18
Concrete foundation ..	16.11	0.19
Cedar Block, Creosoted Block and Cobblestone	27.00	0.12
Granite Block.....	14.04	0.22

The above costs are used in preparing Table 2.

REPAIRING ASPHALT.

(Cost per Sq. Yd)

A flate rate for repairing asphalt, not including foundation, is $1.50.

A 6-in. concrete foundation will cost approximately the same as concrete pavement, or $1.54 per sq. yd.

TABLE 3—HOURS LABOR AND MATERIAL QUANTITIES FOR REPAIRING PAVEMENTS, UNITS PER SQUARE YARD (All old material is used where possible).

	Brick on 6" Concrete	Cedar Block on 6" Concrete	Cedar Block on Sand	Concrete 6"	Creosoted Block on 6" Concrete	Granite Block on 6" Concrete	Cobblestone on Sand
Foreman's time (hrs.).....	0.36	0.80	0.18	0.34	0.36	0.31	0.11
Paver's time (hrs.).....	0.66	0.90	0.44	0.55	0.85	0.76	0.33
Laborer's time (hrs.).....	1.89	1.10	0.67	1.53	2.01	2.43	0.75
Team time (hrs.).....	0.75	1.10	0.44	0.63	0.88	0.64	0.33
Cu. ft. of sand.....	1.18	1.50	1.11	1.20	1.08	1.68	0.76
Sacks of cement.....	0.34	0.30	..	0.60	0.43	0.66	0.03
Gallons of tar.....	1.11	..	..	..	0.72	..	0.18
Brick No. 1.....	3.89	..	..	..	..	..	0.25
Brick No. 2.....	1.65	..	..	..	..	..	..
Sp. yds. cedar block, No. 2..	..	0.65	0.41	..	..	..	..
Sq.yds. creosoted block, No. 1.	..	..	..	..	0.24	..	..
Sq. yds. granite block.....	..	..	..	..	..	0.10	..
Cu. ft. crushed stone.....	0.09	..	..	0.06	0.06	..	..
Cu. ft. gravel.....	..	0.20	0.67	..	..	..	..
Gallons of oil.....	0.01	..	..	0.01	0.01	0.29	..
Luber F. B. M.....	..	..	..	..	..	..	..
Spikes	..	..	..	..	..	..	..
Total number of yards averaged	2187.5	10.0	13.5	685.5	301.0	95.0	127.0

REPAIRING BRICK PAVEMENT ON 6-IN. CONCRETE.

(Cost per Sq. Yd.)

Foreman	0.36 hrs.	@ $0.50	$0.18	
Paver	0.66 hrs.	@ 0.40	0.26	
Laborer	1.89 hrs.	@ 0.25	0.48	
Team	0.75 hrs.	@ 0.44	0.33	
				$1.25
		15%		0.19
				$1.44
Sand	1.18 cu. ft.	@ $0.06	0.07	
Cement	0.43 sacks	@ 0.40	0.17	
Tar	1.11 gals.	@ 0.12½	0.14	
Brick, No. 1	3.89	@ 25.00	0.10	
Brick, No. 2	1.65	@ 18.00	0.03	
Crushed Stone	0.09 cu. ft	@ 0.05	0.004	
Oil	0.01 gal.	@ 0.08	0.001	0.51
		Total		$1.95

REPAIRING CEDAR BLOCK ON 6-IN. CONCRETE.

(Cost per Sq. Yd.)

Foreman	0.80 hrs.	@	$0.50	$0.40	
Paver	0.90 hrs.	@	0.40	0.36	
Laborer	1.10 hrs.	@	0.25	0.28	
Team	1.10 hrs.	@	0.44	0.48	
					$1.52
			15%		0.23
					$1.75
Sand	1.50 cu. ft	@	$0.06	$0.09	
Gravel	0.20 cu. ft	@	0.06	0.01	
Cement	0.30 sack	@	0.40	0.12	
Cedar Block, No. 2	0.65 sq. yds.	@	0.38	0.25	$0.47
Total					$2.22

REPAIRING CEDAR BLOCK ON SAND.

(Cost per Sq. Yd.)

Foreman	0.18 hrs.	@	$0.50	$0.09	
Paver	0.44 hrs.	@	0.40	0.18	
Laborer	0.67 hrs.	@	0.25	0.17	
Team	0.44 hrs.	@	0.44	0.19	
					$0.63
			15%		0.09
					$0.72
Sand	1.11 cu. ft.	@	$0.06	$0.07	
Gravel	0.67 cu. ft	@	0.06	0.04	
Cedar Block, No. 2	0.41 sq. yds.	@	0.38	0.16	$0.27
Total					$0.99

REPAIRING CONCRETE 6-IN.

(Cost per Sq. Yd.)

Foreman	0.34 hrs.	@	$0.50	$0.17	
Paver	0.55 hrs.	@	0.40	0.22	
Laborer	1.53 hrs.	@	0.25	0.38	
Team	0.63 hrs.	@	0.44	0.28	
					$1.05
			15%		0.16
					$1.21
Sand	1.20 cu. ft	@	$0.06	$0.07	
Cement	0.60 sacks	@	0.40	0.24	
Lumber	0.36 F.B.M.	@	35.00	0.01	
Crushed Stone	0.06 cu. ft	@	0.05	0.003	
Spikes	0.03 lbs.	@	0.02	0.001	
Oil	0.01 gals.	@	0.08	0.001	$0.33
Total					$1.54

REPAIRING CREOSOTED BLOCK ON 6-IN CONCRETE.

(Cost per Sq. Yd.)

Foreman	0.36 hrs.	@	$0.50	$0.18	
Paver	0.85 hrs.	@	0.40	0.34	
Laborer	2.01 hrs.	@	0.25	0.50	
Team	0.88 hrs.	@	0.44	0.39	
					$1.41
			15%		0.21
					$1.62
Sand	1.08 cu. ft.	@	$0.06	$0.06	
Cement	0.43 sacks	@	0.40	0.17	
Tar	0.72 gals.	@	0.12½	0.09	
Creosote Block, No. 1	0.24 sq yds.	@	2.00	0.48	
Crushed Stone	0.06 cu. ft.	@	0.05	0.003	
Oil	0.01 gals.	@	0.08	0.001	$0.80
Total					$2.42

REPAIRING GRANITE BLOCK ON 6-IN. CONCRETE.

(Cost per Sq. Yd.)

Foreman	0.31 hrs.	@	$0.50	$0.16	
Paver	0.76 hrs.	@	0.40	0.30	
Laborer	2.43 hrs.	@	0.25	0.61	
Team	0.64 hrs.	@	0.44	0.28	
					$1.35
			15%		0.20
					$1.55
Sand	1.68 (cu. ft.	@	$0.06	$0.10	
Cement	0.66 sacks	@	0.40	0.26	
Granite Block	0.10 sq. yds.	@	2.35	0.24	
Oil	0.29 gals.	@	0.08	0.02	$0.62
			Total		$2.17

REPAIRING COBBLE PAVEMENT ON SAND.

(Cost per Sq. Yd.)

Foreman	0.11 hrs.	@	$0.50	$0.06	
Paver	0.33 hrs.	@	0.40	0.13	
Laborer	0.75 hrs.	@	0.25	0.19	
Team	0.33 hrs.	@	0.44	0.14	
					$0.52
			15%		0.08
					$0.60
Sand	0.76 cu. ft.	@	$0.06	$0.05	
Cement	0.03 sacks	@	0.40	0.01	
Tar	0.18 gals.	@	0.12½	0.02	
Brick	0.25	@	25.00 per M.	0.01	$0.09
			Total		$0.69

Using the above costs per square yard for the various pavements, Table 4 is compiled.

TABLE 4—COST TO REPLACE VARIOUS KINDS OF PAVEMENT PER LINEAL FOOT OF TRENCH.

Width of Trenches, Inches	Sheet Asphalt on 6" Concrete	Brick on 6" Concrete	Cedar Block on 6" Concrete	Cedar Block on Sand	Concrete 6"	Creosoted Block on 6" Concrete	Granite Block on 6" Concrete	Cobblestone on Sand
22	$0.62	$0.60	$0.58	$0.26	$0.28	$0.75	$0.67	$0.17
23	.65	.62	.60	.27	.29	.77	.69	.17
24	.65	.62	.62	.28	.29	.77	.69	.18
25	.68	.64	.62	.28	.31	.80	.72	.18
26	.71	.66	.64	.29	.32	.82	.74	.19
27	.74	.68	.67	.30	.34	.85	.76	.19
28	.77	.70	.69	.31	.35	.87	.78	.20
29	.80	.72	.71	.32	.37	.90	.80	.21
30	.80	.72	.71	.32	.37	.90	.80	.21
31	.83	.74	.73	.33	.38	.92	.82	.22
35	.94	.80	.80	.36	.43	.99	.89	.24
37	.99	.83	.84	.38	.46	1.04	.93	.25
39	1.03	.87	.89	.40	.49	1.09	.98	.26
41	1.08	.89	.91	.41	.51	1.11	1.00	.28

Notes on Compulsory Heating and Ventilating Requirements.

In connection with the requirements for compulsory heating and ventilating laws, which were published in the last issue, the council of the Heating and Ventilating Engineers' Society calls attention, among other things, to the fact that the committee report deals with old buildings as well as new. The city of Chicago makes its ventilation laws apply to both old and new buildings with good results, yet there are some who object to making legal requirements apply to buildings other than new buildings. If, in any case, the suggestions are used to apply to new buildings only, some modified requirements, as near the requirements for new buildings as possible, should, in the interests of public health, be enforced for existing buildings.

If is often desirable to have humidifying apparatus and humidity control, but because of the expense of such equipment, humidity control (except as to keeping down excessive humidity) has been omitted from the suggested requirements.

It is important to note that the suggestions given in the report are for average localities in the United States, taking New York, Boston and Chicago as examples.

Specific rules, not included therein, will be needed covering details of installation and operation, such, for example, as have been formulated and adopted with excellent results by the Department of Health in the City of Chicago and the Industrial Commission of the State of Wisconsin.

The removal from work rooms of objectionable dusts, fumes, gases, vapors, odors, fibres and other impurities created in manufacturing processes, covered by the general requirements in the report, is vitally important and will require specific rules that are practical and that may be widely applied. Space conditions per occupant should, under these conditions, be most liberal. Some good rules for the removal of dust, etc., for manufacturing establishments, have been drawn up by the 1915 Industrial Board of the New York State Department of Labor and by the Industrial Commission of Wisconsin.

The administrative feature of enforcing general ventilation laws are extremely important and experienced and capable engineers are necessary as inspectors and as advisers to the administrative department.

Humidity and Its Measurement.

A Correction.

The last equation given in the article on "Humidity and Its Measurement," on page 37 of the March issue, may need a little further explanation, aside from the fact that a typographical error occurs in one of the equations. The equation to be solved for X should read:

$$0.2375 \times 70 + \frac{1084.7 + 0.48 \times 16 \times X}{7000} = 22.44$$

1084.7 is the total heat of the vapor at 54°F and 16 is the number of degrees superheat of the vapor (the difference between 50° and 70°F.)

The equation simply states that the total heat of the mixture is equal to the heat of the air, plus the total heat of saturated vapor at 54°, plus the heat required to superheat the vapor from 54° to 70°. In the first equation, the vapor is saturated and therefore, the term involving the superheat does not occur.

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ABOUT as personal and searching a character study as could be imagined is that made recently by one of the Carnegie foundations, with the American engineer as its subject. If he has any illusions about himself they stand a good chance of being dissolved in the bright glare that the study has thrown over his training, his mental attitude, his future prospects and about everything else that would be likely to affect him. In announcing the results of the investigation, the engineer is backed up against the wall, so to speak, and told frankly just about where he "gets off," to use a common expression. Here is the general indictment:

Engineers as a rule do not frame the policy for public improvements, but are hired as help; engineers seldom serve in the legislature or on public commissions; in engineering meetings 10% of the members do the talking; engineering literature shows how engineers fail to convey their meaning; engineers cannot convince an audience; only about half of the engineering graduates follow their specialty; many brilliant engineers have no greater earning capacity than carpenters' foremen; and, finally, few engineers arrive under the age of forty.

So much for their public activities. When it comes to their personal characteristics we are told that their engineering spirit and ideals, such as ideals of life, high purpose, professional ideals and understanding of the ultimate aim of engineering, are not properly developed; that they are deficient in legal and political training and in promoting the proper spirit of independence; also that they are lacking in humility and in engineering judgment.

Equally interesting is the list of factors which are given as those that make for success in engineering. These are placed in the following order of their importance, as expressed by the consensus of the opinions received: Character, self-reliance, ability to understand men, engineering spirit, independence, judgment, industry, technical knowledge, scientific attitude, accuracy, efficiency, business sense, breadth of view, ambition, power of expression, humility, application of theory to practice, physique, and, finally, memory.

The investigation went still further, taking up, among other things, the sort of information best calculated to assist in judging fitness and probable success in engineering.

NEW YORK extends the heartiest of welcomes to the National District Heating Association on the occasion of its forthcoming convention in the metropolis. It is a good thing for the district heating engineers to come in touch with eastern affairs, but we venture to think it is even a better thing for New Yorkers to get a line on this breezy and virile organization that smacks of the West.

THE CONSULTING ENGINEER

The Consulting Engineer" is prepared to reply, in this department, to any questions which our readers may ask regarding problems connected with the design and installation of mechanical equipments of buildings.

61—Figuring Capacity of Vacuum Pump.

QUESTION: Is there any known method of determining the required capacity of a vacuum pump for a steam heating system?

ANSWER: It is more or less guess work, as the air leakage and amount of air to be removed from a system in a given period of time is indeterminate in advance and more or less variable in operation. A rule that has been used with good results is as follows: Multiply the condensation as determined by the conditions under which the system is operating by 20 for the displacement of the piston of the pump, with a piston speed of not over 60 ft. per minute, and 50 ft. is better. This simply means a proportion of 19 to 1 of air and water. The condensation is determined by multiplying the square feet of radiation by the B.T.U. loss per hour and dividing by 1,000, or the latent heat at atmosphere and below, or at the pressures and temperatures at which the steam will be condensed.

62.—A Vapor Job That Gives Trouble.

QUESTION: I would like to ask for a little information in regard to a vapor job that I am having trouble with. The building is a 5-story apartment. The heating system works very well with the exception of one riser which is the last riser on the return main. The supply riser in question is taken off the main in the center of a run of about 60 ft. This riser is 1-in. up to the third floor and ¾-in. from the third to the fifth floor. The connections to the radiators are taken from a cross, supplying radiators on each side of the partition. There is a total of 143 sq. ft. of radiation on this riser, 69 sq. ft. of this being on the fourth and fifth floors.

The radiators on the three lower floors get hot with a pressure of about ¼-lb., but the upper floor radiators will not get hot unless there is 1 lb. pressure or more. As soon as the pressure drops below that, the radiators become cool and will not heat up until the pressure is again increased.

When there was ½-lb. pressure, with the third floor radiators hot and the fourth floor radiators cold, I have experimented by disconnecting one of the fourth floor radiators and blowing into the supply pipe. The vapor would start to come up and would throw out about a cup of water.

I have changed the connections at the main floor from the riser by putting in a tee at the bottom of the riser, with a side opening on the riser and connected an opening onto the main, and the other opening to a seal with a drop of about 5 ft. and let it overflow into the return main, but still it would not work.

ANSWER: The description shows that the pipe sizes are too small for the pressure carried. The density of the steam changes quite rapidly at atmosphere and below, and by increasing the pressure the weight per cubic foot increases. If the other risers work all right, take a connection of 1¼ in. or 1½ in. from the boiler direct to the end of the supply main and connect it, covering it well. This will equalize the pressure and this will probably make the riser work. If not, the connection between the main and the radiators is too small and will have to be enlarged.

Another method is to run a pipe to the roof space and connect it to the top of the riser. This depends mainly on the structural conditions in the building.

New Unit Proposed for Measurements and Calculations.

Because of objections to both the metric and English systems of measurement, based on the fact that the unit in each case is not easily divisible, a new system is proposed by the Practical Engineer of Chicago, in which the standard of length is 5 ft., or 60 in., to be called the New Unit, or Nu, for short. The point is made that with the metric system, only 2 and 5 are available as even divisions of the unit, and one-fifth is not a natural or convenient division for ordinary work. On the other

hand, with the decimal system, division into tenths and fifths is bothersome and inaccurate, the natural division being by halves, thirds and quarters.

The unit of 60 in., or 5t ft., is divisible by 2, 3, 4, 5 and 10. It is equal to 1.524 meters, and to 152.4 centimeters, and this conversion factor is divisible by 2, 3 and 4.

With reference to larger measurements the mile is 1056 nu. If a Greater Unit, on gu. be taken, as 1,000 nu. or 5,000 ft., it will equal 1,524 meters or 1.524 km., so that the same conversion multipliers will hold between the gu. and the kilometer as between the nu. and the meter.

For areas the square new unit equals 2,322 square meters or 25 sq. ft., and for volumes the cubic new unit equals 3.54 cubic meters or 125 cu. ft. And to correspond to the gallon, a cube of 0.1 the new unit on a side or 6 in. might be used, giving a volume of 216 cu. in. or ⅛ cu. ft. or 3540 cu. centimeters.

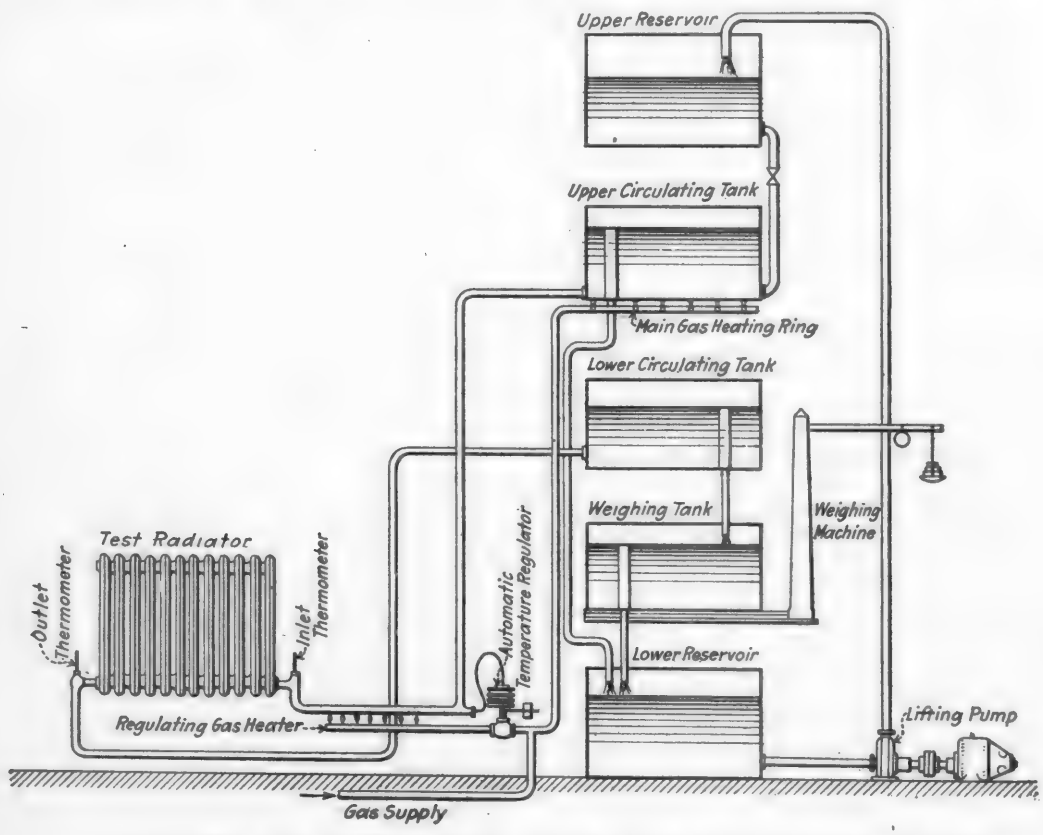
If we wish to divide the new unit decimally, 0.1 nu.=6 in., 0.5 ft., or 15.24 c.m,; 0.01 nu. = 0.6 in., 0.05 ft., or 1.524 c.m. and 0.001 nu.=0.06 in. or 1,524 m.m., all of which maintain the same relative simple relations as the new unit, the foot, the inch and the meter.

Apparatus for Testing Heat Transmission from Radiators.

Supplementing the description in the March issue of the apparatus designed by A. H. Barker, of the University College, London, for measuring heat losses from rooms, an illustration is presented herewith of another apparatus, also designed by Mr. Barker, for determining the actual amount of heat lost from radiators and pipes at different temperatures.

This apparatus has been thoroughly tested and Mr. Barker states that results can be obtained that will be strictly comparable with practical conditions of any type of radiator.

It is proposed that every type and design of radiator be submitted by the manufacturers for tests and that a schedule of the heat emission at all temperatures applicable to the various types be issued by the manufacturers, in place of the currently-accepted heating surface in square feet, and that all calculations of heat emission should be made by these coefficients.



APPARATUS FOR TESTING HEAT LOSSES FROM RADIATORS BY WATER.

Motion Picture Houses in New York City Inadequately Ventilated.

Announcement is made by the New York City Department of Health that 334 motion picture theatre houses out of a total of 518 in Manhattan, Brooklyn and the Bronx, are so improperly ventilated as to be a menace to the public health. It is stated that the proprietors of these houses have stopped the fans which most of them have installed, in order to save expense, and have also kept the entrances and exits tightly closed. In many cases, it is claimed, disinfectants are being used to disguise the odor of the vitiated air. In addition to the 77 houses which are properly ventilated, there were 107 not in operation. This leaves 334 which have been cited to appear before the license commissioner.

The report of the Health Department is the result of a systematic investigation made March 18, last. This date was chosen because the weather was cold and the problem of getting fresh air correspondingly simpler. It was found that almost all the theatres had the facilities with which to comply with the ordinance, but that they did not operate them on account of the cost.

REQUIREMENTS OF DEPARTMENT OF HEALTH REGARDING HEATING AND VENTILATION OF PICTURE THEATRES.

The department's requirements are contained in the city's Code of Ordinances, Chapter 3, covering amusements and exhibitions. Article 2 is devoted to "Motion Picture Exhibitions," and the two sections relating to the heating and ventilation of such places are Sections 37 and 39:

Sec. 37. Heating. When the temperature of the outdoor air is below 60° F., the air in a motion picture theatre, while an audience is present, shall be maintained at a temperature not lower than 62° F., nor higher than 70° F. If gas stoves, oil stoves or other apparatus throwing off products of combustion are used to heat such a theatre, said products of combustion must be carried to the outside air by means of a fireproof flue or flues. No radiator shall be placed in the aisles of such a theatre, so as to lessen the width below the minimum requirements. (C. O. Sec. 352e, subd. 2.)

Sec. 39. Ventilating. Motion picture theatres as defined aforesaid, having less than 200 cu. ft. of air space for each person, or motion picture theatres in which the outside window and door area is less than one-eighth of the floor area, shall be provided with artificial means of ventilation which shall supply, during the time when the audience is present, at least 500 cu. ft. of fresh air per hour for each person.

Motion picture theatres having more than 200 cu. ft. of air space for each person, or having outside windows and doors the area of which is equal to at least one-eighth of the floor area, shall be provided with artificial means of ventilation, that shall be in operation when the outside temperature requires the windows to be kept closed and which shall supply, during the time the audience is present, at least 500 cu. ft. of fresh air per hour for each person.

When the artificial ventilation is not in operation, ventilation by means of open doors and windows shall be sufficient to provide each person with 500 cu. ft. fresh air per hour.

Motion picture theatres having more than 1,000 cu. ft. of air space for each person, and having outside windows and doors the area of which is equal to at least one-eighth of the total floor area, shall not be required to have artificial means of ventilation, provided the air is thoroughly changed by freely opening doors and windows immediately before the admission of the audience and at least every four hours thereafter.

No part of the fresh air supply required by any paragraph of this section shall be taken from any source containing vitiated air. The area of outside doors and windows shall mean the area capable of being fully opened to the outside air for ventilation purposes. Where fresh air is supplied by means of ventilating openings, at least one inlet shall be situated at one end of the room, and at least one outlet at the other end of the room. Where exhaust or inlet fans are necessary, at least one of such fans shall be placed in an outlet opening. The inlet opening or openings shall be placed in the floor or within 2 ft. from the floor and the outlet opening or openings in the ceiling, or within 2 ft. of the ceiling. The inlet openings and their surroundings shall be kept free from dust, so that the incoming air shall not convey dust nor stir up dust as it enters.

During the time spectators are present, the air in the theatre shall be kept continuously in motion by means of fans to the number of at least one to every 150 persons. Such fans shall be placed in positions remote from the inlet and outlet openings. No person shall be exposed to any direct draft from any air inlet. (C. O. Sec. 352e, subd. 3.)

Speaking of the situation, Commissioner George Bell remarked that about two months ago letters were sent out to every proprietor in the city, warning him to comply with the regulations, so that it can-

not be said that this matter has been sprung upon them. The trouble with most of these proprietors is that while they have every facility for keeping their theatres pure and fresh, they will not use them. If the proprietors could only be made to see that it is not only a matter of meeting the requirements of the law, but of good business as well, there would be much less reason to complain of the condition of the theatres in general.

THE EXHIBITORS' REPLY.

Voicing the attitude of the proprietors of motion picture houses, Lee A. Ochs, president of the local branch of the Motion Picture Exhibitors' League of America, declares that the use of ventilating fans is almost an impossibility in cold weather. In a letter on the subject he states: "There are many reasons why it is not possible to continuously have in operation the exhaust or ventilating fans during the winter months, as far as the motion picture theatres are concerned.

"It may surprise you, but it nevertheless is a fact, that instead of the complaint coming from the authorities as to the non-operation, our greatest complaint comes from our patrons when we do operate the fans.

"You, no doubt, readily understand that the tastes and opinions of people assert themselves regarding places of public assemblage and amusement, as well as in the other things which go to make up our every day life. If we open a window somebody says, 'Close it;' if we close the window, somebody says 'Open it,' and if we start the fans we are told there is a terrific draft. In fact, we receive more complaints when the fans are in operation than we do at any other time.

"These fans are very powerful affairs, and there is no question but that they do create a powerful draft when in operation, and the complaints have been many in the theatres which I am interested in, and also in the theatres of the members of our organization that many dangerous and troublesome colds, backaches, muscular pains, etc., have been brought on through the drafts pounding upon backs, heads and other parts of the body of our patrons while our fans were in operation.

"You understand, however, that regardless of the drafts, or the sickness which we are liable to bring upon our patrons and public, we will always continue to comply with the law.

"At the same time you will see that especially during the winter months, although we have kept the fans in operation, the routine is absolutely unnecessary. These fans are not needed in winter time, as the air is clear enough; it is during damp and warm weather that the air becomes foul."

LEGAL DECISIONS

Steam Heating Properties.

In an investigation of the rates, service, rules and regulations of the Colorado Springs Light, Heat & Power Company, the Colorado Public Utilities Commission finds that the present fair value of the company's property in use and useful in the sale of steam heat is $122,774. It further finds that there is an annual deficit, which includes $8,000 annual depreciation reserve, in the sum of $13,912.

The laws of Colorado pertaining to public utilities and the regulation thereof by the Public Utilities Commission of the state enumerate by name all public utilities which shall be under the jurisdiction of the commission, and the commission is of opinion that it is without jurisdiction in the regulation of the sale of steam heat.

Agency for Wife in Contracting for Heating Installation.

Action was brought to recover for materials and labor furnished in putting a heating furnace into the defendant's house under a contract therefor made by her husband, to whom the plaintiff gave credit, supposing him to be the owner of the property. At the time, the defendant was away from home in a hospital. The foundation of the action was the claim that the husband was the wife's agent in the transaction. It was held that the fact that the husband had charge of the farm, that carpenters who had made repairs were employed by him, that he seemed to be in charge of the repairs, that the wife was there while the work was going up, that he had hired workmen for other improvements, and that the wife had paid them with her checks, some of which had been made out by him, that he had employed carpenters for repairs on the house and had given general instructions therefor, were admissible on the issue of his agency for his wife. The evidence was held to support a jury's finding that the husband was the wife's agent in having the furnace put into the house and judgment for the

plaintiff was affirmed.—Lunge vs. Abbott, Maine Supreme Court, 95 Atl., 942.

Damage to Boiler Shipped—Evidence.

A cast-iron heating boiler shipped from St. Paul to Waseca by train, transferred from the train by dray and lowered into a basement, and there installed, was found, after installation, when water was put into it, to be cracked. The crack was variously described as from 2 in. to 6 in. long, and wide enough to allow of the insertion of a thin knife blade. The evidence was that it was carefully handled after it was taken from the train, and received no jars or jolts, but there was evidence that such boilers crack very easily, and there was no positive evidence that it was not cracked while so handled. The evidence was not conclusive that the damage occurred while on the train, and the rule that, when goods are delivered to a carrier in good condition and arrive at destination in damaged condition, a prima facie case of liability is made out did not, as a matter of law, apply. The jury, the Minnesota Supreme Court held, might infer from all the evidence that the boiler was damaged in handling after it left the train, and the case was not one for the application of the rule that testimony uncontradicted and unimpeached cannot be disregarded.—Lewes vs. Minneapolis & St. Louis (Minn.), 156 N. W., 6.

Engineers in Get-Together Movement.

Forty-two national, state and local engineering and technical societies in the United States were represented at a conference on engineering co-operation which was held in Chicago, April 13 and 14, to bring about a closer relation among engineers and engineering organizations, to discuss ways to improve standards of engineering practice and to gain a clearer recognition of the engineer as a civic asset. Among the items discussed during the two-day session were the following:

1. Co-operation among engineering organizations. Is it desirable? In what way is it practicable?

2. Benefits of co-operation in securing greater efficiency in the larger matters of concern to the individual engineer, to the profession and to the public.

3. Methods of co-operation now in practice in various localities; results attained in Philadelphia, St. Louis, St. Paul and other places.

4. Various kinds of engineering societies and committees and the relative efficiency of their operations.

5. Relation of the specialized or exclusive national engineering societies to their local sections or branches and to the more inclusive local engineering society or club.

6. Result of co-operation in securing wider diffusion of knowledge on engineering subjects, as illustrated at Cleveland and elsewhere.

7. The engineering profession as a whole in its present condition as regards public esteem.

8. Reasons for decline in attendance at engineering colleges. Is it indicative of healthful conditions or of proper methods of education?

9. Employment; methods and results as practised by various engineering societies; an exchange of ideas.

10. Legislative activity, proper limits to be set, dangers to be avoided and needs of more systematic and better directed efforts.

At the conclusion of the conference a resolution was unanimously passed providing for the development of a plan for promoting co-operation among engineering societies upon matters of general interest to the engineering profession and to present such a plan at a later conference. F. H. Newell, professor of civil engineering of the University of Illinois, who, with C. E. Drayer, secretary of the Cleveland Engineering Society, were in charge of the meeting, was appointed the chairman of the committee to draw up a co-operation plan. In the preamble of the resolution it was noted that the rapid increase in engineering activity of recent years has given rise to many problems vitally affecting the practice of engineering and that the existing agencies lack proper correlation for the solution of these problems.

The American Society of Heating and Ventilating Engineers was represented at the conference by John F. Hale, of Chicago, former president of the society.

Government Co-Operation With the Trade Press.

A more complete co-operation between the trade press and the Bureau of Foreign and Domestic Commerce of the Department of Commerce, is urged by Dr. Edward Ewing Pratt, chief of this bureau. "We are both going in the same direction," he said. "The Bureau and Department are endeavoring to build up the commerce of the United States, and I have found that the trade papers are not only honestly trying to build up their respective industries, but are succeeding nobly. I believe that the trade papers are the most effective agencies for trade promotion and industrial betterment that exist."

The Society's Summer Meeting.

As announced last month, the mid-summer meeting of the American Society of Heating and Ventilating Engineers will be held in Detroit, Mich. The dates selected are July 19-21, 1916. The newly formed Michigan Chapter will be the host on this occasion, and preparations are going forward to make the meeting a notable one in the history of the society.

April Meeting of Illinois Chapter.

A talk on "Refrigeration and the Cooling of Air in Connection with Ventilation," was given by Thomas C. McKee, of the Carbondale Machine Co., of Chicago, at the April meeting of the Illinois Chapter. The address followed the usual chapter dinner at the Morrison Hotel, Chicago, April 10. Mr. McKee explained the character of the problems that come up in connection with the design of refrigerating apparatus and showed the similarity of refrigerating to heating problems. After the discussion which followed his talk, the chapter was addressed by Benjamin Nelson on the use of air washers for cooling air.

At the business session of the chapter, John F. Hale, Samuel R. Lewis and Dr. E. Vernon Hill were appointed a committee to represent the chapter at a meeting of delegates of various engineering bodies, called for April 13 and 14, in the rooms of the Western Society of Engineers in Chicago. The purpose of the conference was to devise a plan of co-operation between the different engineering societies for the mutual benefit of their members, both educationally and practically.

Annual Meeting of New York Chapter.

A plan was successfully inaugurated at the April meeting of the New York Chapter, held April 24, at the quarters of the Building Trades Employers' Association, in having the details of the program placed in the hands of a special committee. It is proposed to have a different committee for each meeting and in that way secure as wide a co-operation as possible among the members in arranging the programs. The April meeting was planned by a committee headed by P. H. Seward and proved one of the most entertaining ever held by the chapter. The two speakers were R. S. Elberty, of the New York State Compensation Inspection Rating Board, who spoke on "Safety First," and H. DeB. Parsons, who gave an illustrated talk on "Engineering Fallacies."

Mr. Elberty gave many instances from his personal experiences in which accidents occurred that could easily have been prevented and offered many suggestions in the way of "first rules" for avoiding accidents, not only in industrial work, but in the everyday habits of people generally. He cited one question that is put up to factory owners by the insurance rating boards in determining the ratings. This question is: "Is the ventilation sufficient to carry off all poisonous gases and dust?" Where the answer is "good," Mr. Elberty said that a reduction of 1% was made in the rate, and where the answer is "poor" an increase of 1% is made. This, he added, often amounts to a matter of $70,000 per year one way or the other in the rating.

After referring to the losses reported in the present European war, he said that equally significant figures could be reported in connection with the industrial life of America. The factory losses each year, for instance, in killed is no less than 30,000 and the number wounded during the same period is 700,000.

Mr. Parsons was then introduced and held the attention of the members for over an hour describing some of the more important engineering fallacies that had been offered at various times. He spoke first of the perpetual motion devices and showed several that had attracted more than the usual amount of attention. He then took up such schemes as the propelling of boats by jets of water and the use of water wheels for boats, the wheels being designed to ride the water very much as a vehicle travels on land. While many of these had some correct engineering theories back of them, there was almost always the unexpected development that interfered with the success of the schemes. With the boat on wheels, for instance, the presence of a water film on the wheels, as it revolved in the water, unexpectedly added to the power required, while the addition of a larger engine caused the boat to rest too low in the water.

Many so-called inventions also used correct engineering principles in the wrong way. For instance, the use of water jets in propelling a boat, he showed, was not dependent upon the jets being discharged into the water, as was incorrectly supposed, as their action would have been equally effective if discharged into the air. Yet for a long time it was thought that the jets

acted as a rod pressing against the water and thus forcing the boat forward.

Other schemes shown by Mr. Parsons were various equipments of railroad locomotives for increasing either the speed or power, such as the use of driving wheels set on top of the wheels supporting the engine, all of which proved fallacies. He concluded his address with a description of the famous Keeley motor hoax which appeared in the '90's and which was only exposed after the death of the "inventor." It was then found that the innocent-looking wires that connected various parts of the motor were in reality hollow tubes filled with water at a high pressure operated by a hidden assistant and which were responsible for the seeming wonders performed.

At the business session of the meeting Treasurer William J. Olvany reported a balance in the treasury of $265.52. Secretary Frederick K. Davis reported that the present membership of the chapter is 79, of whom 75 are regular members. Ten new members have been added during the year.

The new officers elected are as follows: President, Arthur Ritter; vice-president, Frank K. Chew; secretary, Frederick K. Davis; treasurer, William J. Olvany. Members of the board of governors: W. H. Driscoll, Conway Kiewitz and C. E. Pearce.

The May meeting will be in charge of a committee, consisting of A. S. Armagnac, chairman; William D. Clark, George D. Farnham, A. M. Feldman, W. L. Fleisher, O. H. Fogg, R. B. Hunt, George W. Knight and George O'Hanlon. It will be held May 22, at the Building Trades Employers' Association.

Michigan Chapter.

A membership of fifty was reported at the first regular monthly meeting of the Michigan Chapter, which was held April 3 in the Fellowcraft Club, Detroit. Prof. John R. Allen, president of the chapter, gave a talk on "Heat Losses from Building Structures," and in the discussion which followed, the speakers included J. R. McColl, F. K. Boomhower, J. H. Walker and R. W. Davenport.

Reference to the proposed code of rules and regulations prepared by the Detroit Board of Health for the heating, ventilation and sanitation of motion picture theatres, led to an informal discussion of the requirements as drawn up.

The fact that the society started with a record of having submitted 37 applications for membership in the society is pointed to as a record that will be hard to equal. The appreciation of the society was quickly shown in the decision of the council to hold the semi-annual meeting of the society in Detroit, July 19-21.

It was arranged to hold the regular meetings of the chapter the first Monday evening in each month. The full list of officers is: President, Prof. John R. Allen; vice-president, Fred R. Still; secretary, William F. McDonald; treasurer, Edward M. Harrigan. Board of Governors: E. E. McNair, W. M. Foster and A. G. Pittelkow.

Eastern Pennsylvania Chapter.

Routine matters, including the adoption of the proposed constitution and by-laws, was the principal business transacted at the first regular meeting of the Eastern Pennsylvania Chapter, held at the Engineers' Club, 1317 Spruce Street, Philadelphia, April 13. A chapter dinner preceded the meeting.

Ohio Chapter.

A paper by E. A. Stark of the United States Radiator Corporation, was the principal item at the April meeting of the Ohio Chapter, his subject being "Chimneys and Draft." As it was not possible to have copies of the paper ready for the meeting it was voted to take up the subject again in the Fall, when the paper will be further discussed.

It is planned to have the May meeting a social gathering with a banquet, to be held in the Statler Hotel. Next Fall the chapter will hold its monthly meetings in the rooms of the Cleveland Engineering Society in the Chamber of Commerce Building.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

Annual Convention to Be Held in Atlantic City.

It is announced that the twenty-eighth annual convention of the National Association of Master Steam and Hot Water Fitters will be held in Atlantic City, Wednesday to Saturday, June 21-24, inclusive, with headquarters at the Hotel St. Charles. This hotel has been recently remodeled and an extensive 13-story addition built in front directly facing the boardwalk.

The fact that the National Association of Master Plumbers is to hold its annual convention June 19-22 also at Atlantic City, at The Breakers (formerly the Hotel Rudolf) directly across the street from the St. Charles, will add greatly to the attendance and interest at both conventions, as well as provide the opportunity for co-oper-

ation of the two associations on projects in which both are interested, such as the separation of heating and plumbing from general contracts.

Local Association Formed in Youngstown Ohio.

A local association of master fitters, which is affiliated with the National Association of Master Steam and Hot Water Fitters, has been formed in Youngstown, O., with the following officers: President, C. J. Little; treasurer, T. G. Beede; secretary, Charles W. Wilson. Board of governors: C. J. Little, C. F. Henry and L. B. Scheible.

Newark (N. J.) Association.

Following are the officers elected at the annual meeting of the Newark (N. J.) Local Association, March 21: President, John Nellis; vice-president, John G. Kellar; treasurer, T. B. Cryer; secretary, Harry Geiser. Executive committee: Robert Berla (three years).

New York City Association.

New officers were elected as follows at the annual meeting of the New York City Association, held March 28: President, Joseph G. Geoghegan; vice-president, William H. Curtin; treasurer, J. E. Rutzler; secretary, Henry B. Gombers. Board of directors: Joseph G. Geoghegan, William H. Curtin, J. E. Rutzler, Michael J. Callahan and J. T. Dyas.

Massachusetts Master Fitters Hold Annual Convention.

Successful adjustment of a number of labor and similar problems was reported by President John E. Chatman at the annual meeting of the Massachusetts Association of Master Steam and Hot Water Fitters, which was held in Boston, April 3, at the Revere House. Among other things, President Chatman told of the negotiations that resulted in an increase of 25 cents per day in the wages of the helpers, making the minimum rate $2.75 per day. In regard to the matter of working rules it was settled that the agreement with the fitters amply protected the helpers.

"Up to the present year," continued President Chatman, "the steam fitters who have done work only on sprinkler systems and have been known as sprinklerfitters, have been a part of Local 537, and during the year the sprinklerfitters have withdrawn from 537 and formed a separate sprinklerfitters' union. We have written assurance, however, that the members of Local 537 will continue to perform the work of installing sprinkler systems.

"The question of the installation of vacuum cleaning systems which has been in dispute for two years, has recently been decided by President Alpine to be the work of either steamfitter or plumber.

"The local union of steamfitters and this association have always contended that this was the only just solution of the difficulty but it is doubtful it if would have been decided in our favor if we had not been organized.

"A committee of the association appeared before the State Board of Boiler Rules relative to inspection of boilers, asking for a more uniform interpretation of the rules by the inspectors. While the committee may not have accomplished immediate results, they feel that as an association we are in a stronger position for having frankly placed our case before them.

"Two matters have been considered by the association in connection with proposed legislation. Senate bill 48 was introduced by the union to make it necessary to obtain licenses by journeymen steamfitters and master steamfitters and in accordance with a vote of the association the officers were present at the hearing before the committee on mercantile affairs to oppose the passage of the bill.

"Senate bill 64 for the separation of contracts was introduced by the State Master Plumbers' Association and your officers appeared in favor of it at the hearing before the same committee. Leave to withdraw is the committee's recommendation, and the bill probably will be defeated.

"As a result of a discussion at the regular meeting in May, a special committee was appointed to prepare a standard estimate sheet for the use of the members. After extensive study and discussion at meetings, your committee prepared and had printed a sheet that they feel will be a great assistance in accurately making up estimates."

The new officers are: President, Frank Howard; vice-president, Frank Merrill; treasurer, Walter Ross; secretary, Herbert A. Snow. Advisory board: Frank Cleghorn, J. W. Woodward, Laurence Franklin, David Huey and John E. Chatman.

It was unanimously voted to change the name of the association to the Boston Association of Master Steam Fitters.

The eighth annual meeting of the American Institute of Chemical Engineers will be held in Cleveland, O., June 14-17, 1916.

NATIONAL DISTRICT HEATING ASSOCIATION

Arrangements for Eighth Annual Convention.

Arrangements are now complete for the eighth annual convention of the National District Heating Association, which will be held in New York City, Tuesday, Wednesday, Thursday and Friday, May 16-19, inclusive.

Headquarters will be at the Hotel Martinique where a large part of the second floor will be given over to the uses of the association. Directly adjoining the assembly room will be an exhibition hall, and additional exhibits will be shown in the corridor leading to the assembly room. The program for the professional sessions is as follows:

FIRST SESSION, TUESDAY, MAY 16, 10.30 A. M.

Welcome address.
Response, Byron T. Gifford.
Report of executive committee.
Election of new members.
Address of President David S. Boyden.
Report of Secretary-Treasurer D. L Gaskill.
Appointment of nominating committee.
Report of publicity committee, D. L. Gaskill, chairman.
Report of underground construction committee, H. A. Woodworth, chairman.

SECOND SESSION, TUESDAY, MAY 16, 2.30 P. M.

Report of nominating committee.
Paper, "Factors in the Growth of District Heating," by S. Morgan Bushnell.
Report of station operating committee, Byron T. Gifford, chairman.

THIRD SESSION, WEDNESDAY, MAY 17, 9.30 A. M.

Address, "District Heating and Its Relation to Electric Utility Operation," by Arthur Williams, New York City.
Report of educational committee, George W. Martin, chairman.
Election of officers.

FOURTH SESSION, THURSDAY, MAY 18, 9.30 A. M.

Paper, "Co-operating with Consumer," by Wm. J. Baldwin, Jr., New York Steam Co.
Address, "Appraisals of Utility Property," by M. F. Millikan, American Gas & Electric Co.
Report of rate committee, A. E. Bettis, chairman.

FIFTH SESSION, THURSDAY, MAY 18, 2.30 P. M.

Report of publication and editorial committee.
Paper, "Ratio of Economizing Coils of the Different Types of Heating Systems," by W. J. Kline, New York City.
Report of record committee, A. P. Biggs, chairman.
Paper, "Methods by Which Harvard University Buys Steam on a Heat Unit Basis," by E. G. Bailey, Boston, Mass.

SIXTH SESSION, FRIDAY, MAY 19, 9.30 A. M.

Report of meter committee, F. B. Orr, chairman.
Address by Travis H. Whitney, Public Service Commissioner, New York City.
Report of delegates to Pan-American Congress, Jas. A. Donnelly, New York City, and Nelson S. Thompson, Washington, D. C.

Entertainment Program.

The entertainment program will be in charge of a general committee, composed of George W. Martin, C. A. Gillham, E. F. Tweedy, J. G. DeRemer, C. N. Greene, R. P. Bolton and C. R. Bishop. On Tuesday, May 16, the opening day of the convention, there will be an automobile ride for the ladies to Long View, where tea will be served.

On Wednesday afternoon, May 17, a boat ride has been arranged on the Nassau around Manhattan Island, with possibly a sail past the Palisades and down the lower bay. The boat will start from the Long Island Railroad pier at the foot of East 34th Street, immediately after the close of the morning session. A buffet luncheon will be served on board. It is expected the trip will be over by 6 P. M.

Thursday morning a party will visit the Metropolitan Museum of Art and in the afternoon the ladies will be the guests of the committee at a performance at the Hippodrome.

The association banquet will be held in the evening at the Hotel Martinique. On the conclusion of the dinner, a lecture will be delivered by Reginald Pelham Bolton on "Revolutionary Relics on Manhattan

Island." The hall will then be cleared for dancing.

Friday is open, with possibly a trip to Chinatown.

The chairmen of the various sub-committees are as follows: Exhibit, H. T. Luscomb; automobile ride, C. A. Gillham; boat ride, George W. Martin; art museum and Hippodrome, H. C. Spaulding; banquet, A. S. Armagnac.

Central Station Heating Notes.

Cleveland, O.—An advance in the municipal steam heating rates will be necessary to make the Cleveland municipal heating plant on Fairmount Road self-supporting, according to the recommendations of the commissioner of accounts. The rates were advanced last year from 30 to 35 cents per 1000 lbs., and the present recommendation is that they be advanced to 45 cents.

Hodenpyl Hardy Co., New York, announce the appointment of H. R. Wetherell as the company's steam engineer. Mr. Wetherell will have general supervision of the company's many plants in different sections of the country. He will make his headquarters in New York. Mr. Wetherell is a former president of the National District Heating Association ad was for 12 years superintendent of the heating department of the Central Illinois Light Co.

American District Steam Co., No. Tonawanda, N. Y., announces that H. A. Woodworth, formerly of the Merchants Heat & Light Co., of Indianapolis, Ind., is now connected with the American District Steam Co. Mr. Woodworth is succeeded in the Merchants company by C. J. Cooper, Jr.

Martin & DeRemer, New York, is the title of a new engineering firm composed of George W. Martin, formerly of the New York Service Company, and Jay Grant De Remer, until recently manager of the engineering department of the American District Steam Company. The new firm, which has taken quarters at 100 Broadway, New York, will specialize in utilities and industrial plant work. Mr. Martin is a graduate of the Stevens Institute of Technology. He will still retain his interest in the New York Service Co. Mr. DeRemer is a graduate of the University of California and previous to his going with the American District Steam Co., was vice-president and later chief mechanical and electrical engineer for the United Light & Power Co., of San Francisco.

Madison, Wis.—The United States Supreme Court will be called upon to pass upon that portion of the public utility law which permits a city to purchase the existing utility in a city even though it be but a segment of a large plant. The question arose in the case of the city of Menasha, which has attempted to purchase the property of the Wisconsin Light, Heat and Traction Company, within the confines of the city. The company which operates in Menasha also operates in several other cities, and the portion of the plant in Menasha is on a small segment.

Traer, Ia.—It has transpired that the new electric light company which is to operate in Waterloo is the Iowa Railway & Light Company of Cedar Rapids. The new interests have taken over the heating and lighting plant of F. L. White. The Iowa company holds franchises in many towns. Mr. White's franchise runs for ten more years and it is understood that it carries the steam heating service. It is reported that the new owners woud discontinue the heating service if they could. If not, the power plant in Traer will continue to be operated.

Ames, Ia.—The Iowa Railway & Light Co., owners of the Boone electric light and heating plant, has completed plans for the construction of a new $100,000 plant in Perry this summer. Perry is to be made the hub of the service in the towns in that neighborhood and the current will be sent to these towns by high tension wires. The old plant has been torn down and work on the new one has already commenced.

Grinnell, Ia.—The Iowa Light, Heat & Power Co., located at Grinnell, has announced its intention of putting in a new plant at a cost of $100,000. The present buildings, which have been in use for 30 years, will be retained for storage purposes and the new building will go up on the next lot south. This company has transmission lines to Brooklyn, Malcom and Kellogg, with the prospect of further extension in the near future.

Osage, Ia.—The Osage Electric Light, Heat & Power Co., has submitted a proposition to the city council asking for a renewal of its franchise which will expire in eighteen months. The new franchise calls for a revision of rates, making them conform to the rates in Charles City, Hampton and other towns in which the electric lighting plants are owned by an eastern corporation. It is understood that if the franchise is granted the Osage plant will also be taken over by the eastern corporation.

Sleepy Eye, Minn.—A proposition of installing a central station heating plant in Sleepy Eye has resulted in a subscription

of $15,750 being raised toward the project to date. A committee composed of J. L. Kiefer, Frank Scobie, Charles Baugatz and L. A. Larsen of St. Paul, has been interviewing the citizens on the project with the result that considerable interest has been aroused and subscriptions secured to the amount stated. An organization was later perfected with J. L. Kiefer as president and Frank Scobie, secretary, and W. W. Smith, Hans Mo. and William Brust directors. Mr. Larsen has been commissioned to draw up the necessary plans and specifications, the idea being to have the plant ready by next fall.

Spokane, Wash.—According to D. P. Reid, secretary ,of the Public Welfare League, nearly 2,000 names have been turned in up to the last of March in the referendum against the steam heating and lighting franchise granted to Fred B. Grinnell. It is estimated that enough additional names will shortly be secured to make the referendum effective. As announced in recent issues, the Grinnell interests have been seeking a franchise in Spokane for some time, although the Merchants' Central Heating Company is already in the field. The Merchant's Company has not only made extensive plans to supply heating service in the city, but is also arranging to enter the electric field September 1. For the necessary equipment to furnish both services upwards of $1,000,000 is being invested by the Merchants' company. Contracts for the delivery of steam heat have already been closed for 38 buildings and connections have already been made to 17 of these.

Des Moines, Ia.—The proposed heating franchise in favor of the Des Moines Electric Company has been rejected by the voters of that city. The franchise was opposed by the Labor League of Des Moines which made a house to house canvass on the proposition. At a convention of the United Mine Workers of America, District No. 13, held previous to the vote, a resolution was passed to the effect that the measure would mean the loss of permanent employment of from 700 to 1,000 laboring men in Des Moines. On the other hand, the franchise as proposed received the endorsement of the Greater Des Moines Committee, the Des Moines Commercial Association, the Chamber of Commerce, the smoke abatement commission, the mayor and other city officials and many business men. It was, of course, reviewed and passed by the city council and submitted by that body to the electors of the city for ratification. In addition to the opposition of the labor men, there was some opposition on the part of certain business men who saw in the application of the franchise an endeavor by the electric company to secure an over-lapping contract with the city under which it might continue serving the city with electric power after its present light franchise expires in 1919. The service would only have affected the downtown district, as only the portion of the city bounded by Second, Court, Mulberry, Tenth and Pleasant Streets would have been reached by the system. The Des Moines Electric Company is operated by the McKinley interests of Illinois. The McKinley interests are controlled by the Sun Insurance Company of Montreal, owned by Canadian, English and New England capitalists. Fred Buffe of Peoria, publicity manager for the McKinley interests, and Charles S. Bradshaw, attorney for the company, represented the company's interests in its efforts to secure the franchise.

Correcting Water Troubles in Steam Radiators.

Referring to an item published in the January issue in the Consulting Engineer department on water troubles in steam radiators, a correspondent writes that he has had some experience with trouble of this kind and in each case he corrected the same by installing a swing check valve in the return line at the boiler.

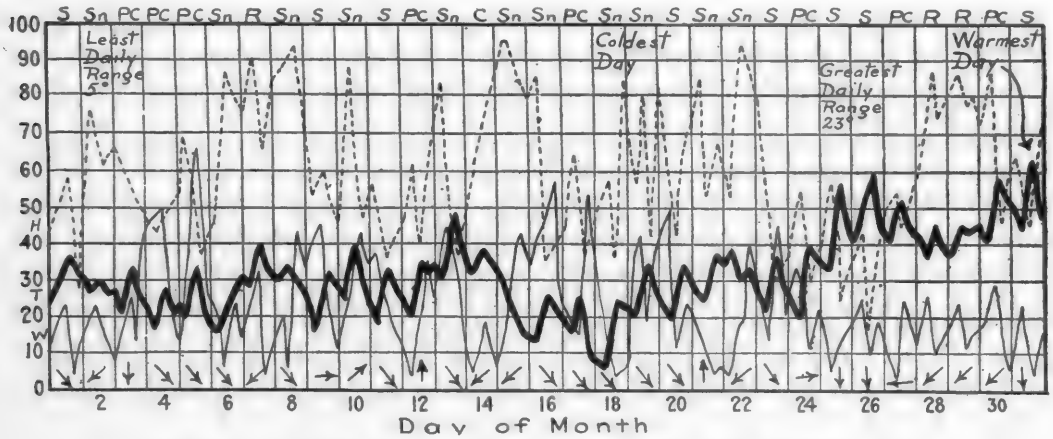
Industrial Arts Index of Technical Articles.

In connection with the indexing of trade and technical articles, our readers will be interested to know that the Industrial Arts Index, published by the H. W. Wilson Co., White Plains, N. Y., is a cumulative index of about 80 engineering and trade periodicals. All articles of any importance are indexed under as many subject-headings as the contents demand. The Industrial Arts Index is issued five times a year, in February, April, June, October and December, and each number is fully cumulated from the beginning of the year to date of issue. This makes it unnecessary to use any but the latest number at any time for a complete record for the year to date of issue. The subscription rate to the Index is based on the number of periodicals which each subscriber receives. Three annual numbers of the Index have been issued to date, covering 1913, 1914 and 1915.

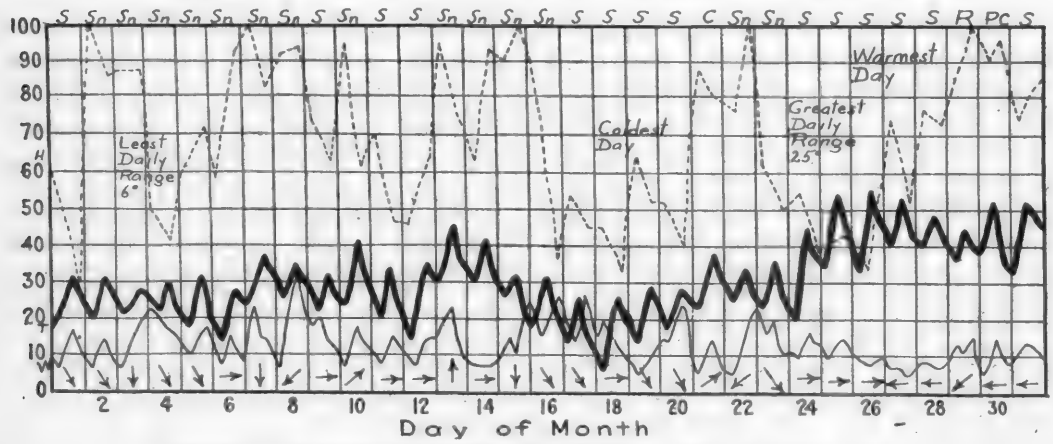
Among the periodicals regularly indexed is THE HEATING AND VENTILATING MAGAZINE.

The Weather for March, 1916.

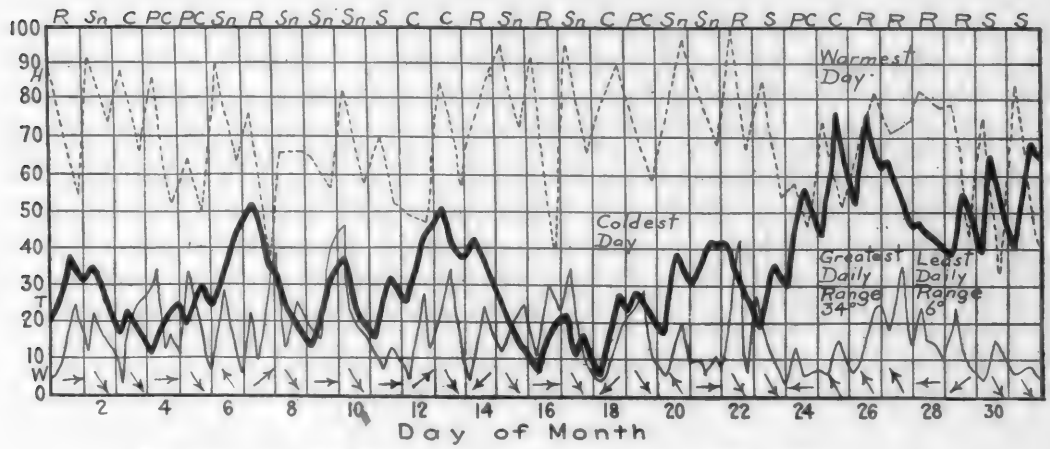
	New York.	Boston.	Pittsburgh.	Chicago.	St. Louis.
Highest temperature, degrees F	63	55	77	72	80
Date of highest temperature	31	26	25	25	13
Lowest temperature, degrees F	7	7	6	12	15
Date of lowest temperature	18	18	18	4	4
Greatest daily range, degrees F	23	25	34	32	48
Date of greatest daily range	25	24	25	24	22
Least daily range, degrees F	5	6	6	3	6
Date of least daily range	2	3	28	27	1
Normal temperature for month, degrees F	32	31	34	34.6	45.0
Normal mean temperature for month, deg. F.	37.5	35	39.5	34.4	43.5
Total rainfall, inches	3.71	3.2	3.63	2.48	1.83
Total snowfall, inches	25.5	33	11	5.5	9.4
Normal precipitation this month, inches	4.1	4.08	3.01	2.55	3.43
Total wind movement, miles	14,674	8,870	9,718	11,396	11,320
Average hourly wind velocity, miles	19.7	11.9	13.1	15.3	15.2
Prevailing direction of wind	N.W.	W.	N.W.	N.	N.W.
Number of clear days	8	16	7	7	12
Number of partly cloudy days	13	4	5	9	8
Number of cloudy days	10	11	19	15	11
Number of days on which rain fell	15	15	18	13	9
Number of days on which snow fell	11	14	9	5	2
Snow on ground at end of month, inches	..	..	..	..	..



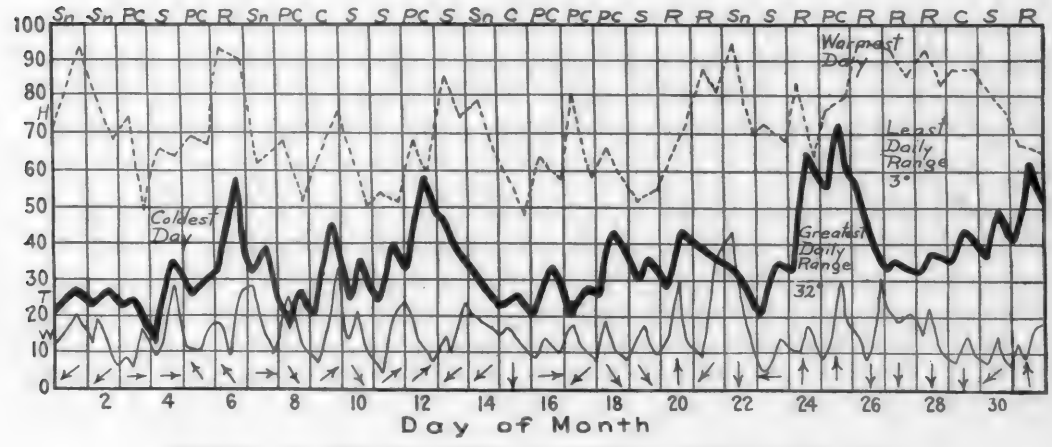
RECORD OF THE WEATHER IN NEW YORK FOR MARCH, 1916.
(Hourly Observations of the Relative Hu midity Are Plotted on this Chart.)



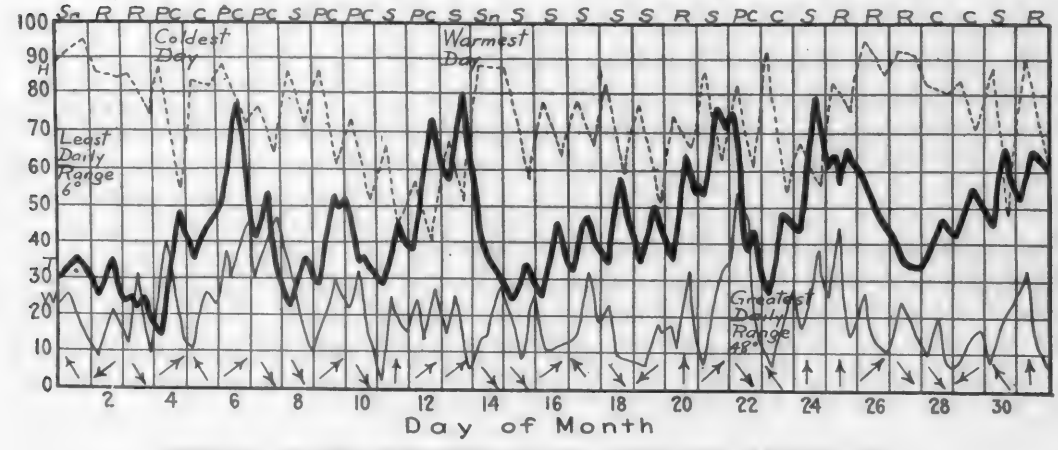
RECORD OF THE WEATHER IN BOSTO N FOR MARCH, 1916.


R Sn C PC PC Sn R Sn Sn Sn S C C R Sn R Sn C PC Sn Sn R S PC C R R R R S S
Warmest Day
Coldest Day
Greatest Daily Range 34°
Least Daily Range 6°
H
T
W
Day of Month

RECORD OF THE WEATHER IN PITTSBURGH FOR MARCH, 1916.


Sn Sn PC S PC R Sn PC C S S PC S Sn C PC PC PC S R R Sn S R PC R R R C S R
Warmest Day
Coldest Day
Least Daily Range 3°
Greatest Daily Range 32°
H
T
W
Day of Month

RECORD OF THE WEATHER IN CHICAGO FOR MARCH, 1916.


Sn R R PC C PC PC S PC PC S PC S Sn S S S S S R S PC C S R R R C C S R
Coldest Day
Warmest Day
Least Daily Range 6°
Greatest Daily Range 48°
H
T
W
Day of Month

RECORD OF THE WEATHER IN ST. LOUIS FOR MARCH, 1916.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P. M.
S—clear, PC—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.

CORRESPONDENCE

Relation of Bernoulli Theorem to Heating and Ventilating Work.

EDITOR HEATING AND VENTILATING MAGAZINE:

Referring to the article in your February issue on "The Principle of Bernoulli and Its Relation to Heating and Ventilating of Buildings," I would call your attention to the following errors:

1. The principle (or theorem) of Bernoulli holds only for inelastic fluids, such as liquids to which water, etc., very closely approximate. Where, under changing conditions, internal work is done, the equation fails utterly. Such occurs in all gases to which, therefore, the Bernoulli theorem does not apply, as the internal change of energy must be taken into account.

2. The boat illustration (Fig. 3) is unhappily in error. The velocity on either side of a perfectly symmetrical boat at points equidistant from the bow will be equal. The divergence of the bow tends to force anything away therefrom, with reverse conditions at the convergent or latter part of the boat, this being increased by the suction effect of the propeller. There is no direct effect tending to force two boats together, the opposite being quite as common, but does not impress the mind as much as a collision.

The relation between two boats is quite complex, depending on relative velocities,

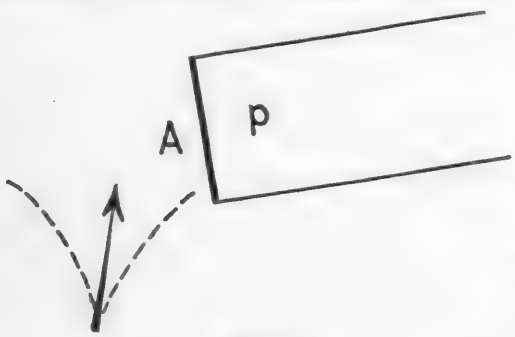


FIG. 1.

size, distance apart, rate of wave propogation, lack of symmetry, etc. There is a tendency at the divergent part of a boat to force things away that are within its radius of influence, with reverse conditions at the convergent part, the water no longer being at rest, nor the surface flat.

3. Relative to the effect of wind on a heating system, there is none on a closed system, such as a steam or hot water system. On an open system, as with hot air, the effect may take place at either the

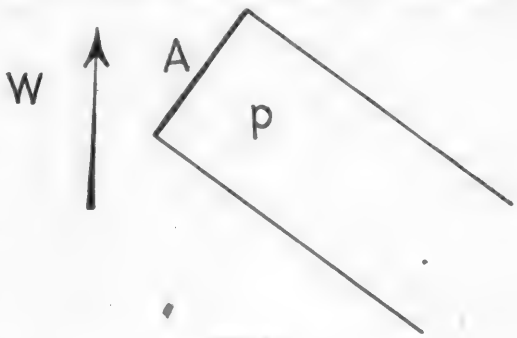


FIG. 2.

inlet or outlet or both. Four cases present themselves (W) indicating the direction of the wind, (A) being the opening, and (p) the relative pressure (plus or minus) caused by the heat in the system.

Case A. Fig. 1, (p) positive. The tendency here is to divert the streamline of (W) away from (A), causing by reaction, a throttling effect on the heating system. With (W) great enough, the direction of flow may be reversed.

Case B. Fig. 1, (p) negative. The effect is reversed, and the tendency is to cause an increase of flow in the system.

Case C. Fig. 2, (p) negative. The influence is similar to Case A.

Case D. Fig 2, (p) positive. Similar to Case B.

OTTO B. GOLDMAN.

Portland, Ore.

REPLY BY S. R. WILLIAMS.

I would state that your correspondent does not seem to be conversant with the facts or with the literature concerning Bernoulli's principle. If he will read the article a second time he will note that I start off by carefully defining what is meant by a steady state of flow, which is the simplest case to consider. Secondly, the equation which I gave always applies to a fluid in which friction is ignored.

To say that the principle of Bernoulli does not apply to gases is incorrect and is a statement against the opinion of the best authorities. If the principle of Bernoulli does not apply to gases, can your correspondent state why the apparatus shown in Fig. 2 in my article works as well with a gas as with water?

The boat illustration which my critic calls attention to is an old stock illustration which he will find given in a very in-

teresting article by W. S. Franklin in the Journal of the Franklin Institute for January, 1914, entitled "On Some Phenomena of Fluid Motion." If he has not two boats to try this particular experiment on, he can try the experiment proposed by Mr. Franklin, viz., to blow between two light balls which are suspended by long cords near each other. Not only will he discover that he always has a collision between the two balls but, in addition, he will find that the principle of Bernoulli applies to the gas which exhales from his mouth.

In "error 3" your correspondent seems to have completely misunderstood the article. I have not said there was any effect on a steam or hot water heating system as there is on a hot-air system. The air in the house, no matter how it is heated, will be sucked out by the principle of Bernoulli, and in the case of a hot-air furnace even the air which circulates through it may be caused to go in a reverse direction is my contention.

Cases A, B, C and D, which he cites, if I understand them, have nothing to do with the case which I considered. I discussed the problem where the stream lines of flow of air are made to converge between two houses, and when this occurs an aspirator effect pulls the air out through the cold air duct of a hot-air furnace, no matter at what angle it is set in the wall, though usually the opening to the cold air shaft is flush with the surface of the house past which the air is flowing.

In conclusion, if your correspondent will look up any advanced, up-to-date textbook of physics he will find much to interest him concerning the Bernoulli principle. An article by Bergen Davis in the American Journal of Science for September, 1900, will afford one other very interesting application of Bernoulli's principle to a gas.

I would consider it a great favor if your correspondent would refer me to the authorities on which he bases his arguments.

The Proposed Compulsory Requirements for Natural and Mechanical Ventilation of School Buildings.

Editor HEATING AND VENTILATING MAGAZINE:

I have read with a great deal of interest your report of the recommendations of the American Society of Heating and Ventilating Engineers relative to the heating and ventilation of buildings (April, 1916, issue). After a report has received the endorsement of such an eminent body of men of unquestioned ability, the very fact of my going so far as to question any part of it brings to mind the old saying, "Fools enter where angels fear to tread," and yet, if I may be pardoned, there is one portion of the report that appears to me as being unjust and misleading and, if after further consideration, such is found to be the fact, a correction should be made. I refer to Section 2, Article 9 (Gravity Indirect Systems).

If this article as a whole were to be placed before a body of legislators who are not acquainted with the facts, they could hardly come to any other conclusion than that natural ventilation, if it is possible to avoid it, should be barred from all school buildings, whether large or small. The effect of this article, as I interpret it, is to recommend that a law be passed enabling all pupils who attend a large school to enjoy the amount of ventilation the law requires, but the pupils attending smaller schools do not seem to be of as much importance, as they may be served by an inferior system that does not comply with the requirements for large school buildings.

I am surprised that the society should take such a position. It is a fact that mechanical ventilation can be installed in every school building built, either large or small, and if I were convinced, as the society seems to be, that it is the only means of meeting the requirements, I would recommend that it be installed in all school buildings. I would not recommend an inferior scheme for one building and a superior one for the other. If, on the other hand, I were convinced that both natural or mechanical ventilation could be installed to comply with the requirements, I would then recommend that either be used, but in either case the law must be rigidly complied with. It appears to me the position of the society is somewhat weak on this point.

I now draw your attention to the conditions the society recommends shall exist in school buildings at the time they are to be tested when natural ventilation is installed. The rooms are to be maintained at 70° F., the warm air entering the rooms is to be 40° above the outside air and under such conditions 30 cu. ft. of air per minute per pupil is to be delivered.

Now let us suppose we are testing a schoolroom under this recommendation. The temperature outside is zero; 1,800 cu. ft. of air per minute must be delivered into the room at not over 40°. This air must be reheated after entering the room to an even temperature throughout of 70° and then exhausted through the exhaust flues. I submit that with either mechanical or natural ventilation, with 1,800 cu. ft. of 40° air entering the room per minute, the down draft

would be so intense that the pupils could not remain long enough to make the test. I submit further that no schoolroom in America has ever been operated under such conditions with any kind of a system of ventilation nor has any building ever been tested with such conditions existing. It would be uninhabitable, whether the air was delivered by a fan or with heat.

If the conditions mentioned in this article are the proper conditions to test any school building, why not specify the same conditions for mechanical ventilation, as well as natural? On the other hand, if these are not the proper conditions to test any school building, why recommend them as the ones that must obtain where natural ventilation is installed?

So far as our own practice is concerned, we neither favor nor condemn either mechanical or natural ventilation. We design both and are very particular that either must comply with the law, which is the same in other respects as the requirements recommended by the society. When our plants are completed, we always have the tests made by the superintendent of schools who is independent of contractors, architects and ourselves, and therefore the tests can be relied upon. From the few tests of school buildings having natural ventilation, which are enclosed herewith, I do not think the members of the heating engineers' society will regard that natural ventilation is unfit either for large or small buildings.

I would very much appreciate a statement from some member of the society explaining the meaning and reasons for the language employed in this article.

C. F. MIDGLEY.

Salt Lake City, Utah.

Current Heating and Ventilating Literature.

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

HEATING—

Electric Heating: Its Present Position and Future Development. George Wilkinson. Also discussion. Ills. 13 pp. I E E Jl—Jan., 1916. Apparatus for automatic temperature control. 20c.

HEAT LOSS—

Heat Loss Calculations. R. W. Noland, with discussion. 4000 w. Ind. Eng. Soc.—1915. Unreliability of methods. 20c.

HUMIDITY—

The Theory of Humidity. C. Harold Berry. 3500 w. S Jl E—Feb., 1916. Attempt to formulate consistent theory. 20c.

NEW DEVICES

A New Fluid Meter for Steam, Water and Gas.

The measurement of steam flow is one of the most difficult engineering problems that has ever been attempted. It resolves itself into two parts: (1) to obtain a pressure difference that varies in a known and definite manner with the rate of flow, and (2) to accurately measure, record and integrate the rate of flow by means of this pressure difference.

At first a great deal of experimenting was done with Pitot tubes and multiple hose nozzles and many variations were tried in their design. In the experiments conducted by the Bailey Meter Co., of Boston, Mass., they proved to be very unreliable in all cases except in long runs of straight pipe, and even there the latter did not maintain its accuracy for any reasonable length of time.

After extended investigation, this company devised a special type of orifice which has proved to be an excellent means of securing the required pressure difference. It

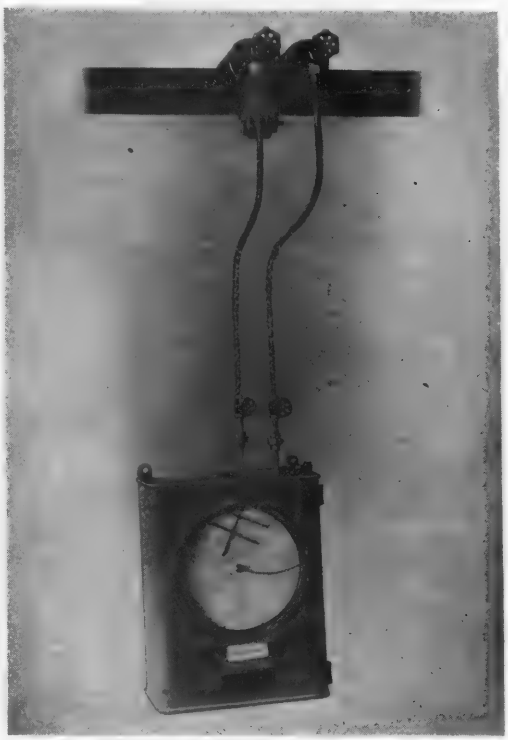


FIG. 1.—BAILEY FLUID METER ATTACHED TO A PIPE LINE.

has the advantage of low cost, easy installation, and of giving constant accuracy over long periods of time. The size of the orifice is suitably proportioned to the size of pipe and the meter capacity desired, so that the company's standard recorder can be used from the lowest to the highest velocities without changing the piping in any way.

The pressure loss caused by the orifice is never more than about 1 lb.

This meter works upon the principle of accurately measuring the pressure difference across an orifice placed between a pair of flanges in a pipe line, as shown in Fig. 1.

The special orifice plate used is made of 1/32-in. monel metal and is corrugated near its outer edge so that it forms its own gasket. The size of the orifice is proportioned to the size of the pipe, the quantity and density of steam or other fluid flowing through it, so that about ½-lb. pressure drop is secured at average rates of flow.

A sectional view of an orifice installed in a horizontal pipe is shown in Fig. 2. This particular orifice is of segment shape which is used in high velocity work so as to secure the correct pressure difference without undue obstruction. Circular orifices of relatively smaller diameter are used for lower capacities. In such cases a small drain hole is located in the orifice plate at

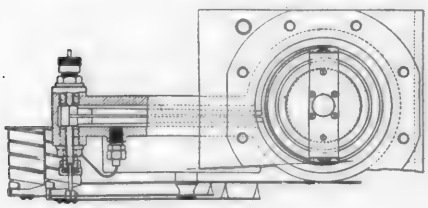


FIG. 2—DETAIL OF RADIATORS TO KEEP WATER LEVEL AND TO MAINTAIN EQUAL TEMPERATURES IN CONNECTING PIPES.

the bottom of a horizontal steam pipe to prevent any accumulation of water

When metering steam it is necessary to have the bell casing and cementing pipes completely filled with water up to an equal and constant level. Each time the bell rises or falls some water is drawn down in one pipe and an equal volume forced up in the other. It is practically impossible to have large enough reservoirs on a level with the steam pipe connections to answer this purpose, but the radiators, shown in Fig. 2, consisting of a horizontal piece of ½-in. copper pipe with a number of washers or fins, serve to keep the water level

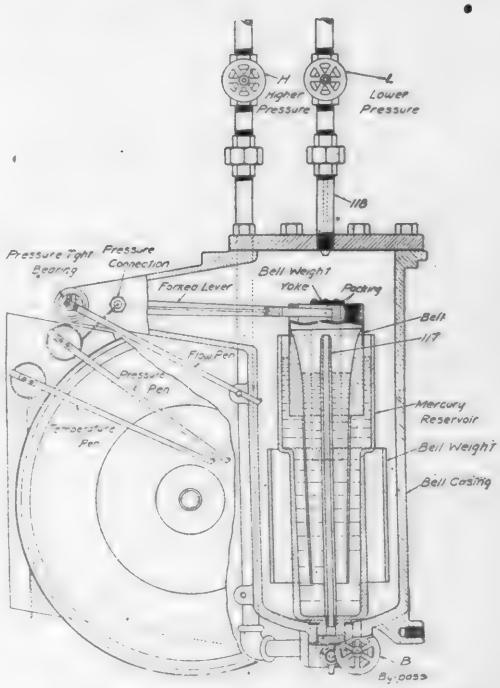


FIG. 3.—CONSTRUCTION OF BAILEY FLUID METER.

and at substantially equal temperatures in the two connecting pipes.

There are but two moving parts in the recording part of this meter. The pressure difference is applied to opposite sides of a special-shaped bell sealed in mercury, and this acts like a frictionless piston, using the buoyant action of the mercury on the walls of the bell to balance the force due to the pressure difference. The bell has a variable cross sectional area so that the recorder gives a reading which varies in direct proportion to the rate of flow, so that charts with uniform graduations are used and the records can be easily read and averaged or totaled with a Radiometer.

Fig. 3 shows in detail the construction and operation of the Bailey fluid meter, and applies to the main operating parts of Types C to C 4 inclusive. The higher and lower pressures from the up-stream and down-stream sides of the orifice are connected to valves H and L respectively. Valve B is a by-pass which serves to equalize the two pressures when desired. From Valve H., the higher pressure is conducted through pipe 90 and tube 117 to the space within the mercury-sealed bell. From Valve L, the lower pressure is conducted through tube 118 to the interior of the casing, which is subjected to full pipe line pressure of the steam or other fluid being metered.

The liquid shown in the reservoir is mercury and the entire casing and piping

are completely filled with water at all times when used as a steam or water meter. The bell is entirely closed, except at its lower end, which is sealed by the mercury contained in the reservoir, so that the pressure H, applied through tube 117 to the space within the bell, which is in excess of the pressure L, applied through tube 118 to the space without the bell, tends to push the bell upward in proportion to the pressure difference.

The shape of the bell in this meter is designed in accordance with the actual flow curve corresponding to the pressure difference and rate of flow through the orifice, so that a direct reading chart with uniform graduations is used and the proper integrator motion is secured without adding to the friction or complexity of the mechanism.

New Type of Air-Seal for Hot Water Heating Plants.

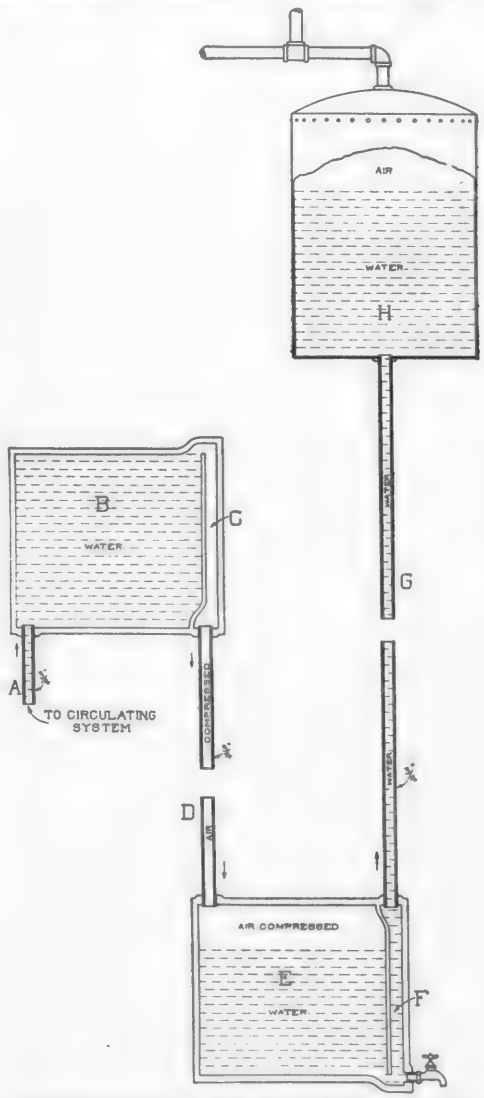
A new application of the principle of an air-seal for sealing the water in a hot water heating system from the atmosphere until a safe and predetermined low pressure has been produced, has been developed by M. C. Honeywell, inventor of the Honeywell line of heating specialties, and has just been placed on the market by the Honeywell Heating Specialties Co., Wabash, Ind.

By referring to the accompanying illustration, it will be seen that the generator consists of two simple castings, or partitioned chambers, called air separators. One is designed to be placed on the first or second floor and the other in the basement. One opening in the upper separator connects with the circulation system, while from the other opening in the upper separator, a pipe is dropped to an opening in the lower separator. Passing upward from the lower separator is a pipe extending to the expansion tank.

When the system is first filled, the cold water passes into the boiler and radiators and when these are full, enters expansion pipe A, forcing the air from upper separator B, into compartment C, and thence down air pipe D, which joins the two separators. When water fills chamber B, it passes over the top of the web into compartment C, down pipe D, into E. When this action takes place most of the air is forced down into the lower separator E, where it is effectively trapped at its top, due to the position of the web in this separator. As the water continues to flow, it passes into compartment F, up pipe G, and fills tank H, which action compresses the air trapped in lower separator E.

Instantly after the water is turned off and the flow stops, the air that is trapped and compressed in lower separator E, enters and fills air pipe D, and compartment C. Thus is established a differential between the air in pipe D, and the water in pipe G—this difference in weight equalizing approximately ½-lb. for each foot in height between the two separators. The action that takes place in the generator during filling, as above described, applies in like manner to its regular operation under normal conditions.

It is stated that it is impossible to dislodge or blow the air out of the generator under 100 lbs. water pressure when filling the system; neither is it possible for air



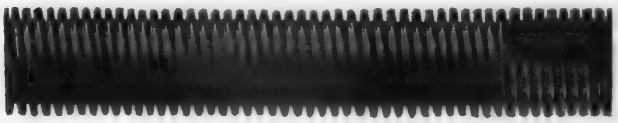
CONSTRUCTION OF HONEYWELL AIR-SEAL GENERATOR, SHOWING APPARATUS PRODUCING FULL PRESSURE.

to be drawn from the upper separator into the system, when the water cools and contracts.

The generator is furnished in four sizes, two for plants containing 1,500 sq. ft. or less of radiation and for buildings of different heights, and two for plants containing 1,500 sq. ft. or more of radiation, also for buildings of different heights. The generator is the subject of a newly-issued circular giving complete information, including designs for typical installations.

TRADE LITERATURE.

SARCO TEMPERATURE CONTROL is the title of a new circular featuring the Sarco temperature regulators, made by the Sarco Co., Inc., now located in the Woolworth Building, New York. Special attention is called to the actuating part of these regulators, consisting of a thin, spirally-corrugated tube, which, it is stated, differs from every other appliance made for the same purpose.



SPIRALLY-CORRUGATED TUBE USED IN SARCO TEMPERATURE REGULATORS.

The metal is of special composition to secure elasticity, resiliency and unvarying quality. Although spirally-corrugated, the corrugations are not annular, so that when the tube is expanded or contracted, the movement is equal on every turn of the spiral. It is stated that there is no deterioration with this tube after many years of service. Attention is also called to the point that the Sarco spiral is the only tube which will permit the use of liquid as an expanding and contracting agent. This principle is applied in the Sarco tank and room temperature regulators, a special illustration being included, showing the operation of the regulator accompanied by the necessary descriptive matter. Size 6 x 9 in. (standard).

VAPOR TALK, devoted to "common sense heating for comfort and economy," is a unique publication, recently issued by the Haynes Selling Co., 1711 Sansom St., Philadelphia, Pa. The publication is devoted to modulated and vapor heating, featuring the Haynes modulating valves, the Haynes thermostatic valves, the Haynes regulators and the Haynes air controllers. The greater part of the circular is taken up with general data on the subject of heating, running from "methods to determine the correct amount of radiation to be used" to systems of piping required, sizes of steam mains for direct radiation and similar tables. Size 3½ x 6 in. (standard). Pp. 32.

NATIONAL TUBE COMPANY bulletins (Nos. 25 and 26) have been issued by the National Tube Co., Pittsburgh, Pa. Bulletin No. 25 is an elaborate publication, devoted to "National Pipe in Large Buildings." National pipe service is taken up in detail accompanied by brief statements of some of the advantages of this pipe. Considerable space is then given over to a discussion of steel pipe, with quotations from the leading authorities on its durability. An imposing array of buildings is shown in which National pipe is used and the remainder of the catalogue is filled with important miscellaneous data for the engineer. This bulletin, it is stated, is not intended for general distribution, but rather for architects, constructing engineers and large building contractors. Size 8½ x 11 in. (standard). Pp. 88.

Bulletin 26 is devoted to "Autogenous Welding of National Pipe," and contains an elaborate presentation of this subject, profusely illustrated. The different divisions of electric welding, blowpipe welding and thermit welding are all discussed, with many views of the welding processes being applied. The illustrations, which are mostly photographic reproductions of the various processes as used, number 88. Size 8½ x 11 in. Pp. 52.

Seventieth Anniversary of Heating Firm.

More than 100 employees of the B. G. Carpenter Co., of Wilkes-Barre, Pa., were guests of the company recently at a dinner in honor of the seventieth anniversary of the company's organization. During the course of the evening the history of the B. G. Carpenter Company was brought out in detail from the early days of the business to its present position as one of the largest heating and plumbing engineering and contracting firms in Eastern Pennsylvania. It was stated that during the past year alone the company's sheet metal department has fabricated over 2,500,000 lbs. of sheet metal, used 150,000 ft. of steel angle-iron, 20,000 bars of solder and over 3,000,000 rivets. About 400 carloads of material have been handled over the Carpenter switch in the year's time. A large part of the success of the company, it is stated, is due to the efficient service of its engineering staff, composed of W. E. Pulverman, O. A. Vincent, A. L. Sanford, D.

P. Carter and H. F. Bantham. The officers of the company are: President, B. H. Carpenter; secretary and treasurer, J. Ed. Wilson.

Unique Industrial Exhibition in Jersey City.

Instead of grouping the exhibits in any one hall or building, the manufacturers and retail merchants of Jersey City, N. J., who are co-operating in an industrial exhibition of Jersey City made goods, to be held June 5-10 next, are planning to have each retail merchant turn his store into a show room for some particular manufactured article, which is made in that city and which he can commercially handle.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF THE HEATING AND VENTILATING MAGAZINE, published monthly at New York, N. Y., for April 1, 1916.

State of New York, } ss.
County of New York, }

Before me, a notary in and for the State and county aforesaid, personally appeared A. S. Armagnac, who, having been duly sworn according to law, deposes and says that he is the Editor of The Heating and Ventilating Magazine, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher, Heating and Ventilating Magazine Co., 1123 Broadway, New York.
Editor, A. S. Armagnac, 1123 Broadway, New York.
Managing Editor, None.
Business Manager, Gustave Petersen, 1123 Broadway, New York.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent. or more of the total amount of stock).
Heating and Ventilating Magazine Co., 1123 Broadway, New York.
A. S. Armagnac, 1123 Broadway, New York.
Gustave Petersen, 1123 Broadway, New York.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are:
None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

A. S. ARMAGNAC, Editor.

Sworn to and subscribed before me this 21st day of March, 1916.

(Seal) A. L. SCANTLEBURY, No. 173.
Notary Public Kings County. Certificate filed in New York County.
(My commission expires March 30, 1917.)

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TRADE AND MISCELLANEOUS NOTES

Coming Events.

June 14, 1916.—Annual meeting of the National Warm Air Heating and Ventilating Association, in Detroit, Mich.

June 20-22, 1916.—Thirty-fourth annual convention of the National Association of Master Plumbers, in Atlantic City, N. J. Headquarters at The Breakers (Hotel Rudolf).

June 21-24, 1916.—Twenty-eighth annual convention of the National Association of Master Steam and Hot Water Fitters, in Atlantic City, N. J. Headquarters at the Hotel St. Charles.

July 19-21, 1916.—Semi-annual meeting of the American Society of Heating and Ventilating Engineers, in Detroit, Mich.

Deaths.

Robert Spice, Sr., Fort Wayne, Ind., a well-known heating and plumbing contractor of that place, was killed March 16 by falling from the roof of a three-story building. He was 59 years old and had been connected with the trade for over 25 years. He leaves a son, who has been associated with him in business. He is also survived by his widow and daughter.

James McLean, assistant treasurer of James B. Clow & Sons, Chicago, Ill., died at his home in Wheaton from cerebral apoplexy. He had long been connected with the company and at the time of his death was at the head of the office force.

Miscellaneous Notes.

Building operations for March made a splendid showing, the figures for 114 cities, as compiled by the "American Contractor," indicating a net gain of 18% over the corresponding month a year ago. The total for New York City reached $18,039,878, as against $14,083,815 a year ago. Chicago reported permits amounting to $11,477,100, as

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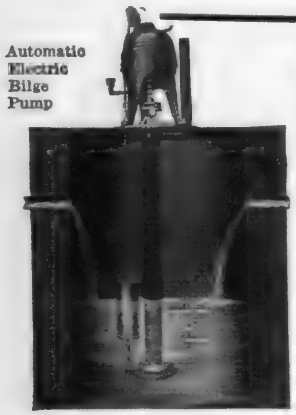
against $7,403,750 in March, 1915. Other cities to show important gains are Baltimore, Chattanooga, Detroit, Kansas City, Los Angeles, Norfolk, Pittsburgh, San Francisco, St. Louis, St. Paul, Toledo and Washington. Losses were reported by Boston, Cleveland, Philadelphia and Rochester. The Boston figures are $3,967,000, as compared with $4,719,000 a year ago, and in Philadelphia the figures are $4,590,730, as compared with $5,388,265.

Nashville, Tenn.—The proposed new building code for Nashville will shortly be presented to the Board of Commissioners for approval by Commissioner of Buildings George J. Tompkins and Building Supervisor James Yeaman. The requirements, it is expected, will greatly increase the installations of ventilating systems and fire-extinguishing apparatus.

Detroit, Mich.—Complaints of poor air conditions in a tabernacle at Woodward and McLean Avenues, in Highland Park, used for evangelistic services, led to an order being issued by the village health officer, Dr. J. C. Martin, forbidding any more meet-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ings until better air was provided. The officials of the tabernacle promptly installed the necessary ventilators.

Chicago, Ill.—The following rules of health have been adopted by the Open Air Crusaders, an organization of Chicago school children:

I will try—

1. To have fresh air where I work or play.
2. To stay outdoors as much as possible.
3. To sleep with my windows open, or on the porch.
4. To breathe through my nose and with my mouth closed.
5. To bathe my body every day, or at least once a week.
6. To keep my clothes clean and tidy.
7. To sit up straight in school all the time.
8. To help my school teacher to keep our schoolroom clean and well ventilated.
9. To ask the manager of the moving picture shows in my town to have theatres clean and well ventilated.
10. To clean my teeth, especially at night before going to bed.
11. To see that no dirt or rubbish is in my yard, alley, or street.
12. To be careful not to spit in public places.
13. To eat plenty of good nourishing food.
14. To see that there are no flies or rats where I live.
15. To influence my family and friends to help me keep these rules.
16. To always wear my badge and sing the Open Air Crusader song.

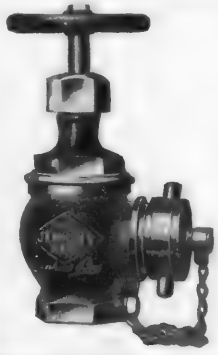
Lansing, Mich.—Chimneyless houses, elimination of furnace work and of ashes from household routine, and smokeless residence districts are predicted within the next few years for Lansing and similar localities by Clark R. Graves, manager of the Lansing Fuel & Gas Co. With the rapid development of gas appliances, he states, and the universal demand for gas, it will be used for heating homes at the old price of 90 cents per 1,000 cu. ft. According to Mr. Graves, there are at the present time more than 700 different kinds of appliances for as many different uses of gas for lighting, heating, cooking and power.

Syracuse, N. Y.—The State College of Forestry at Syracuse University is practically assured of a heating and power plant to cost $29,000, through a bill providing for the necessary appropriation which has been introduced in the legislature by the Senate Finance Committee and the Assembly Ways and Means Committee. The item was eliminated from the budget, making a special appropriation necessary.

Boston, Mass.—In connection with an agitation in Boston for the better ventilation of motion picture theatres, Prof. George C. Whipple of Harvard University, who is a member of the State Health Council, suggests the following rules for this type of building:

A moving picture theatre should first be provided with a good air intake. That is, if possible, the air should not be sucked in directly from the street. Sometimes it is impossible to get very clean air. In such a case what is obtained should be purified, presumably by passing through a wall of pure water. It can, however, be fairly well done by passing it through cotton bags.

Air which is too cold cannot be taken in



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Jenkins Bros. Hose Valves for fire protection service are of strong, heavy pattern, and regularly fitted with Jenkins No. 93 Disc. This is a rubber disc of tough, flexible composition, suitable for hydraulic pressures up to 250 pounds. Does not stick or corrode.

Genuine Jenkins Bros. Valves always have trade mark as shown in the cut.

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New York Boston Philadelphia Chicago Montreal London

SPECIFY— FOXBORO —INSTRUMENTS

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TO INDICATE or RECORD TEMPERATURES and PRESSURE

They have a distinctive quality with a fineness of mechanical detail which insures Accuracy and Durability under the hardest Service

THE FOXBORO COMPANY, FOXBORO, MASS.

New York Chicago St. Louis Birmingham, Ala. San Francisco

advantageously. If you take it in much below 60° F., it is almost certain to offend some person's bald head. This may be overcome, however, by warming the air with the proper machinery.

As air is passed into the theatre it must be made sure that the temperature of the clean air is below that already in the theatre in order that the warmer and less clean air may be naturally forced toward the top and exit.

In dealing with the air the proper relative degree of humidity, or quality of moisture, should be considered.

The air ought not to come into the theatre at a speed of more than 5 ft. per second, and at least 30 cu. ft. per person should be provided every minute.

The question of outlets for used air is important. The outlets should be so regulated as actually to get a good displacement of any and all parts where there are persons. Most important is the question of keeping the air moving in order to get rid of the heat put out by the human body.

The moving picture theatres, in many instances, are placed in comparatively small spaces, considering the number of persons who attend. As this makes less cubic feet of air per person, the problem of ventilation becomes the more delicate and difficult.

Charleston, W. Va.—A new building code is being compiled for Charleston by a committee consisting of Friend Cochrane, chairman; Councilmen John A. Thayer, H. H. Noel, P. L. Gordon and W. E. Mathes. Public hearings have already been held on the proposed code, and it is expected that the City Council will shortly take final action on it.

Jamestown, N. Y.—A proposal to install a central heating plant to serve the High School and the Second Street Grammar School, to be built in the southwest corner of the High School campus, has been drawn up and was to be submitted to the school voters of Jamestown on April 14. It is estimated that such a heating plant, with steam mains to the building and the remodeling of the steam lines in the buidlings, will cost about $39,000. The mechanical and heating features of the proposed plant were designed by W. H. Carrier of the Carrier Engineering Corporation, and bids have already been received for the installation. The estimates on the heating work, including boilers and steam fittings, are: Chatfield & Sharpe, Jamestown, $12,147; McGinity & Johnson, Jamestown, $12,406; John W. Danforth, Buffalo, $10,886. Bids for the subway from the heating plant to the High School building and steam lines in subway were as follows: American District Steam Co., North Tonawanda, N. Y., $4.669; James P. Calahane, Jamestown, $3,214; Chatfield & Sharpe, $2,945; McGinity & Johnson, $5,135; John W. Danforth, $3,630.

For maximum delivery of every pound of steam generated—

Installing J-M Section Conduit at State School of Mines, Rapid City, South Dakota

J-M Sectional Conduit

Records show that J-M Sectional Conduit saves in delivery at least 90 per cent of the heat lost in underground transmission through unprotected or poorly insulated pipes.

It saves from 10 to 20 per cent of the coal required and at the same time reduces fire insurance rates and the expense of operatives.

J-M Service superintends a careful installation of the whole conduit system. The worth of this installation service is evidenced by the many large underground installations throughout the country which are giving our clients the utmost satisfaction.

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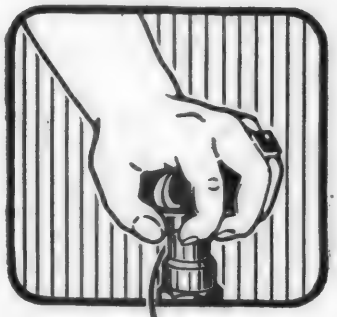

JUST FITS *the* GRIP

See how this smooth, well-rounded mahogany handle just fits the grip.

It has a big, comfortable feeling to the hand, and enables a sure grip without the possibility of being burned by contact with hot metal.

This is just one of a thousand **exclusive** features of Detroit Packless Valves—and one that your clients will readily appreciate. Catalog V tells the rest.

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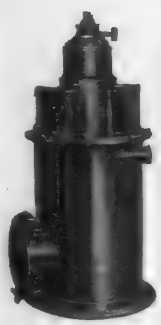
LARGEST MANUFACTURERS OF RADIATOR VALVES IN THE WORLD

New York.—Hoggson Bros., New York, announce the execution of a contract with Charles H. Ingersoll, the watch manufacturer, president of the Commonwealth Hotel Construction Corporation, and his associates, for the construction of a new $15,000,000 hotel to be located in the Times Square district of New York City. The building will occupy an entire block front and will be 28 stories high. It is planned to contain 2,500 rooms, making it almost twice the size of the largest hotel now in existence. The contract taken by Hoggson Bros. covers the services of architects, engineers, builders and decorators, in addition to building materials and furnishings.

New York School of Heating and Ventilating Alumni Association has been formed of men who have taken the course conducted by Charles A. Fuller, during the last few years, in New York City. It is planned to hold regular meetings of the new organization on the third Tuesday of each month in Room 511 of the World Building, New York. At the organization meeting the following officers were elected: President, M. J. Sage, Sage Bros., Brooklyn; first vice president, E. A. Kingsley, Callahan, Kingsley Co., Inc., New York; second vice president, A. H. Bosworth, the H. B. Smith Co., New York; secretary-treasurer, Albert D. Hoxie, 176 West Broadway, New York; assistant secretary, J. H. Timmerman, Walker & Chambers, New York. Trustees: D. A. Dornheim (one year), H. W. Curry (two years) and J. Barton Garfield (three years).

Manufacturers' Notes.

Consolidated Engineering Co., Chicago, Ill., which recently took over the plant and equipment of the Massachusetts Fan Co., Watertown, Mass., announces that manufacturing of Massachusetts fans is now in progress at this plant. The manufacture



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are manufactured in sizes from ¾ H. P. to 40 H. P.

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¾ H.P.Equipment HARTFORD, CT.

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AIR CONDITIONING APPARATUS

WEBSTER Air Washer and Air Conditioning Apparatus is constantly demonstrating its ability, under a wide variety of exacting conditions, to effect and maintain any desired temperature or humidity.

Whenever a highly efficient and thoroughly dependable air washing, air cooling or air conditioning system is required, WEBSTER Apparatus, by reason of its exclusive advantages, is selected by engineers, architects and owners.

No air conditioning problem is too difficult for us to solve. Our air conditioning engineering staff is second to none in existence. Give us the opportunity to prove this by taking up your next air conditioning problems with us.

We guarantee results in any problem we undertake.

Catalogue sent on request.

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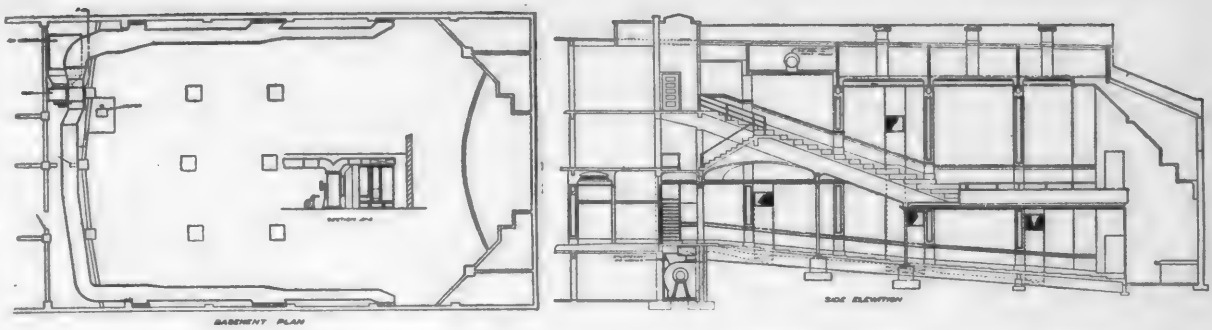
Established 1888. Branches in Principal Cities



Architects, Hanker & Cairns, Memphis

Majestic Theatre, Memphis, Tenn., Showing location of Sturtevant Fan, Sturtevant Air Washer, Heating Ducts and Registers.

Sturtevant
(REG. U. S. PAT. OFF.)

Ventilating and Cooling System in a Theatre

In Memphis, Tennessee, the summer temperatures are high, going up to 110 and even 120 degrees. To ventilate and cool the Majestic Theatre a Sturtevant Fan and Air Washer were installed. The main supply fan in the basement delivers 22,000 cu. feet per minute at ½" static pressure. The air washer has a capacity of 22,000 cu. feet per minute and the velocity through it is less than 400 feet per minute. Air Washer is guaranteed to remove 98% of the solid matter, and 98% of all gases soluble in water, in the air, also to cool air leaving the washer 85% of the initial wet bulb depression, when using recirculated water.

Sturtevant Engineers will co-operate with engineers on all problems.

B. F. STURTEVANT COMPANY

HYDE PARK, BOSTON, MASSACHUSETTS

And All Principal Cities of the World.

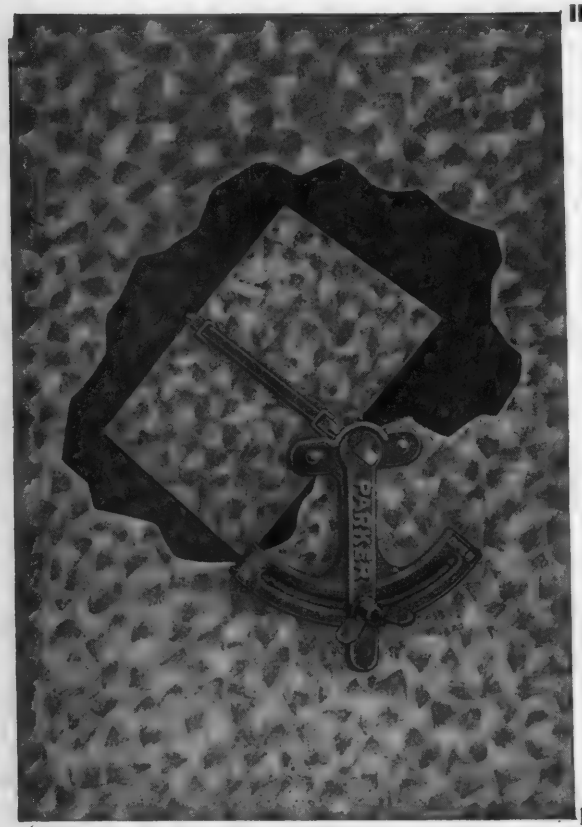
of the Kinealy air washers has also been transferred to Watertown. In addition to the appointment of John E. Anderson, as the company's sales manager in charge of the blower, fan and air washer departments, the company announces that Charles E. Lawrence, formerly manager of the New York office of the Massachusetts Fan Co., and recently with the American Blower Co., is associated with Mr. Anderson, but making his headquarters in the New York office of the company, at 103 Park avenue, where he handles all eastern sales connected with his department. The company's new factory and offices at Twenty-eighth place and Shields avenue, Chicago, is now completed and the new quarters were occupied early in May.

Howard & Morse, New York, manufacturers, engineers and contractors for fan equipment and installations, announces the retirement, at his own request, of B. F. Stangland, after an active service of 37 years in the company's employ. The position held by Mr. Stangland during this long period will be filled by C. H. Quirk, whose training during the past ten years, the company states, has fitted him for his new duties. Mr. Stangland has made an enviable reputation for himself during his long connection with the heating and ventilating trade. He is a charter member of The American Society of Heating and Ventilating Engineers, and served for many years on the society's board of governors. He has also occupied the chair on occasions during the sessions of the society. He is known as a conservative, constructive force in the development of fan engineering, and his advice has been often sought on trade subjects. He is also a member of The American Society of Mechanical Engineers.

Parker Supply Co., New York, manufacturers of the Parker line of damper quadrants, expansion bolts, screw anchors, etc., announces the removal of its main offices and works to 785-787 East 135th street, New York, where the company will have more room and added facilities at its disposal.

Kanawha Mfg. Co., Charleston, W. Va., manufacturers of the Bernhard line of heating boilers, is building an addition to its plant which, it is stated, will more than double its boiler manufacturing capacity. The addition is of fire-proof construction.

Newport Boiler Co., Chicago, Ill., manufacturers of the Newport magazine-feed heating boiler which was recently placed on



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PARKER DAMPER QUADRANT

—the ideal combination.

Have you a copy of our new booklet?

PARKER SUPPLY COMPANY

Makers of Expansion Bolts, Screw Anchors, Toggle Bolts and Sheet Metal Workers' Specialties.

785-787 East 135th St., New York

TEMPLE OF THE SCOTTISH RITE

THE new Temple of the Scottish Rite at the corner of the Avenue of the Presidents and S Avenue in Washington, D. C., is one of the finest, if not the finest, in the world. The building stands on a plot 250 feet square and will ultimately have a background of tall trees.

The Temple is heated and ventilated by Sturtevant Fans and Mitre Type Heaters.

It is a notable fact that in buildings of the very highest character and where quality products are chosen for every detail, Sturtevant Heating, Ventilating and Air Conditioning Apparatus is usually installed.

We will co-operate with Architects or Heating and Ventilating Engineers, on problems big or little

B. F. STURTEVANT COMPANY

HYDE PARK, BOSTON, - - - MASSACHUSETTS

And All Principal Cities of the World

Sturtevant

(REG·U·S·PAT·OFF·)

the market, has opened an office and salesroom at 105 South Dearborn street, Chicago. The office is the headquarters of Charles F. Newport, the inventor of the boiler, and H. F. Horton, who are in general charge of the sales department.

L. O. Koven & Bro., manufacturers of galvanized iron water tanks, expansion tanks and other products for the heating and plumbing trade, has removed its New York main offices to 154 Ogden avenue, Jersey City. N. J., where the company's new factory is located. The building is three stories high, with basement, and is devoted entirely to the company's business.

E. B. Badger & Sons Co., Boston, Mass., manufacturer of the Badger self-equalizing expansion joint and other products for the heating and plumbing trade, has opened a branch office in New York in the Architects' Building, 101 Park avenue. D. J. Dever is in charge.

New York.—The following manufacturers have placed themselves on record as being prepared to furnish valves to meet the requirements of the boiler code recently adopted by the mechanical engineers' society: American Steam Gauge & Valve Mfg. Co., Boston; Ashton Valve Co., Boston; Consolidated Safety Valve Co., New York; Crosby Steam Gage & Valve Co., Boston; and the Lunkenheimer Co., Cincinnati, O.

Underground Specialties Co., Inc., New York, announces that it is prepared to furnish a complete line of equipment for central station heating plants. Charles H. Staten, for many years with the H. W. Johns-Manville Co., and a familiar figure at conventions of the National District Heating Association, is president of the company.

Rathbun-Jones Engineering Co., Toledo, O., manufacturer of the Rathbun gas engine, has appointed J. D. Cudney as its sales manager. Mr. Cudney was for some time associated with the Alberger Gas Engine Co. and its subsidiary companies, the Alberger Heater Co., and the Howard Iron Works, as sales manager.

Robertshaw Mfg. Co., Youngwood, Pa., has completed the construction of a new brass foundry at its plant in Youngwood and will hereafter make its own castings for its line of valves and other products. Frederick W. Robertshaw is the president of the company.

Warren Webster Co., Camden, N. J., has appointed P. H. Chisholm, manager of the company's New Orleans branch at New Orleans, La., which takes in the states of Louisiana and Mississippi and include Mobile, Ala., and Pensacola, Fla. Mr.

Carrier Equipped

buildings for **Public—Industrial**—and **Office** use are

COOL IN SUMMER
WARM IN WINTER

and have an abundant supply of pure, fresh air all the time.

Other systems may be cheaper—other guarantees may be higher—but **results** are what count. And to be sure of getting the **best results** specify

CARRIER

There is no equal.

Shall we send our engineer —or catalog 13-36?

Both are waiting to tell you WHY.

CARRIER AIR CONDITIONING COMPANY OF AMERICA

Buffalo, N. Y.

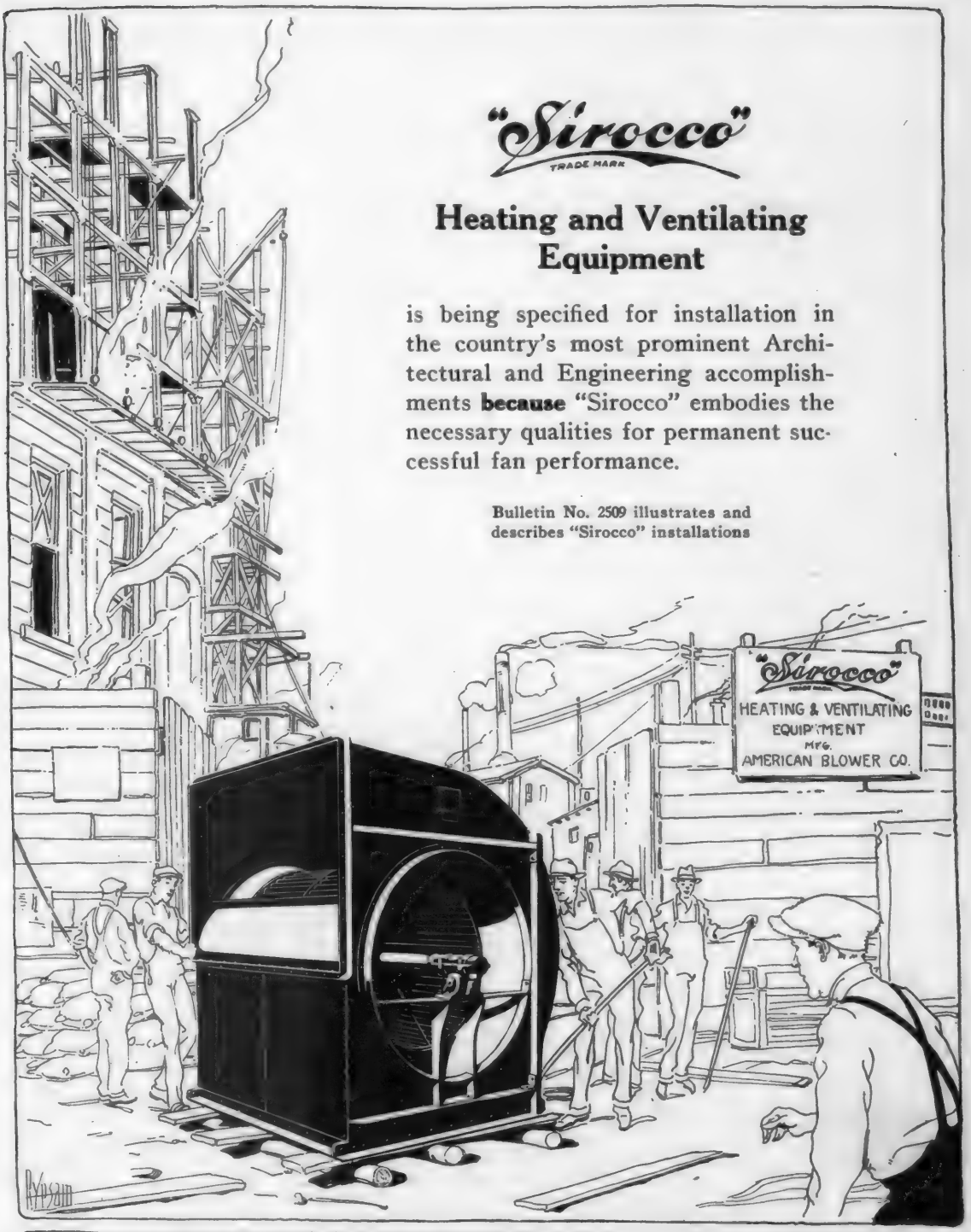
New York Boston
Chicago Philadelphia

"Sirocco"
TRADE MARK

Heating and Ventilating Equipment

is being specified for installation in the country's most prominent Architectural and Engineering accomplishments **because** "Sirocco" embodies the necessary qualities for permanent successful fan performance.

Bulletin No. 2509 illustrates and describes "Sirocco" installations



AMERICAN BLOWER COMPANY
DETROIT, MICHIGAN

Chisholm previously represented the company in Houston, Tex.

Molby Boiler Co., New York, manufacturer of the Molby line of down-draft steam and hot water boilers, has moved to new quarters in the Architects' Building, at 101 Park Avenue.

New Incorporations.

Modern Plumbing & Heating Co., Paris, Tex., capital $5,000. Incorporators: P. Kahn, P. J. Reaney and W. E. Thacher.

Trenton Plumbing & Heating Co., Trenton, N. J., capital $50,000. Incorporators: Albert E. Schoeller, George Kuhn and John Koehler, all of Trenton.

Graves Heating Co., Chicago, Ill., capital $2,500. Incorporators: Williard B. Graves, Grace A. Graves and Harry D. Allen.

National Heating and Ventilating Co., Bloomington, Ill., capital, $10,000. Incorporators: P. H. Magirl, Ben Cones and Charles I. Will. Mr. Magirl is president and treasurer of the company, and Mr. Cones is manager.

Virginia Heater Corporation, Richmond, Va., capital $100,000. President, James D. Goodwin; vice president, Grover C. Goodwin; secretary and treasurer, F. A. Carter, all of Richmond.

J. Wallace Grace Co., Wakefield, Mass., capital $15,000, to conduct a heating and plumbing business. Incorporators: J. Wallace Grace, William W. Grace and Ethel E. Grace.

Hall Heating & Plumbing Co., Pittsburgh, Pa., incorporated to conduct a heating, plumbing and lighting contracting business. Incorporators: Thomas W. Hall, Clyde U. Shank and E. J. Ellsworth.

Anderson-Deering Co., Boone, Ia., capital $10,000, to conduct a heating and plumbing business. President, Andrew G. Anderson; secretary, James J. Deering.

Sanitary Plumbing & Heating Co., Superior, Wis., capital $12,000. Incorporators: C. R. Fridley, E. L. Henton and G. B. Hudnall.

Farnsworth Mfg. Co., Boston, Mass., to take over the business of F. C. Farnsworth, New York, manufacturer of the Farnsworth line of heating specialties. Incorporators: Frederick C. Farnsworth, Kenneth L. Lindsey and H. W. Evans.

Reliable Heater & Mfg. Co., Cleveland, O., capital $2,500. Incorporators: G. A. Bartholomew, Thomas Pry, J. R. Whitacre and R. B. Hartwig.

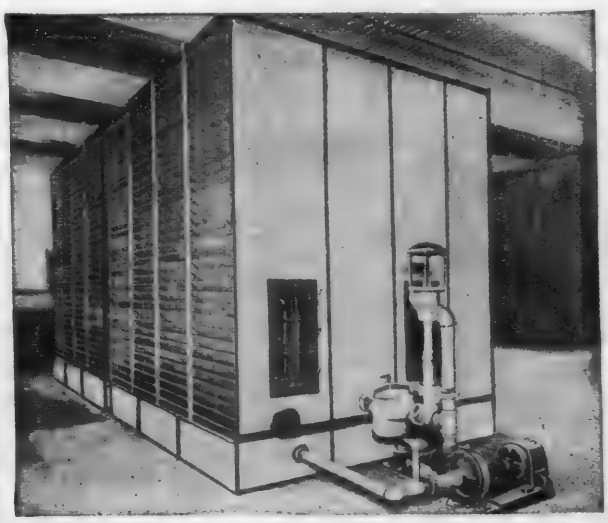
H&M Thermometers
A Visit To Our Plant By You
To Investigate OUR Facilities, will set aside any question as to our preminence in the field of Industrial Thermometry. You can then see for yourself the processes and system of inspection and tests that have made Tycos the synonym for unsurpassed accuracy in the measurement of temperature.
We are specialists in the manufacture and design of H&M Type Thermometers, Tycos Recording and Indicating Thermometers, Automatic Temperature and Pressure Regulators, Mercury Vacuum, and Absolute Pressure Gauges, Engraved Stem Thermometers, Hydrometers, Hygrometers, Thermo-Electric and Radiation Pyrometers, and many other measuring instruments used in the industrial, chemical and metallurgical arts.
The H&M Division
Taylor Instrument Companies
Rochester, N.Y.

Would you take the judgment of Thomas A. Edison?

Nobody will deny that Thomas A. Edison has a keen instinct for picking out the best way to do things—and a good part of his success is due to his ability to select advising engineers with this same ability.

Thomas A Edison
INCORPORATED
Orange, N.J., U.S.A.

"We have found our Carrier Air Conditioner perfectly satisfactory in every respect. We use it in connection with a 3-ton York Refrigerating Machine and find it removes all particles from the air and also keeps a constant temperature and humidity. The apparatus has given us entire satisfaction."



The fact therefore that these men have chosen the Carrier System to keep the air clean, and to keep temperature and degree of moisture just right in his laboratories needs no further comment.

One or more clients, each rated at over $1,000,000 and covering fifty different industries, have called upon us to help solve their air conditioning problems and install Carrier Apparatus. The engineers who planned and erected these and many other installations are at your service and their advice is free.

Carrier
Engineering Corporation
39 Cortlandt St., New York
Boston Philadelphia Buffalo Chicago

Collins Bros. Plumbing & Hardware Co., St. Louis, Mo., capital $5,000, to conduct a heating and plumbing business. Incorporators: David J. Collins, Thomas T. Lapping and William H. Scott.

Moorshead Car Heating and Licensing Corporation, New York, capital $20,000, manufacturer and dealer in protected articles. Incorporators: A. J. Shamberg, J. H. Jones, A. L. Mooreshead, of Rutherford, N. J.

Stearns Register Co., Detroit, Mich., capital $20,000, to manufacture registers, heating appliances and steel stampings. Among the stockholders are J. A. Isaac and L. Stearns.

Ford Foundry & Heating Co., Cuyahoga Falls, O., capital $25,000. Incorporators: Herman A. Drakem, Frank B. Walker, William T. Davies, Michael Strehler, O. H. Sherbart and William F. Sherbart.

Jos. H. Duffy, Inc., capital $10,000, has been incorporated to continue the heating and plumbing business of Jos. H. Duffy. Incorporators: W. L. Sayers, W. J. Powell and B. J. Duffy, all of 335 Second avenue.

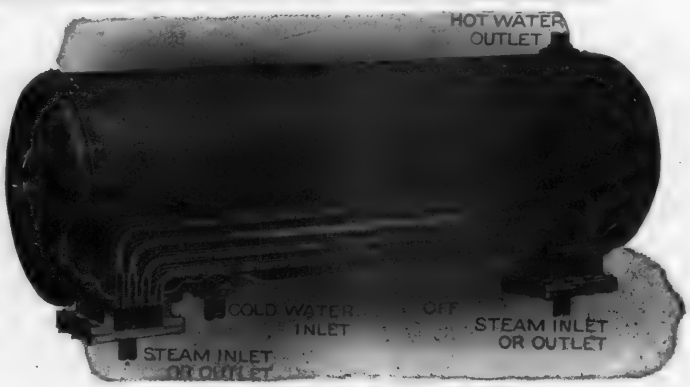
Sanitary Engineering Co., Lake City, Minn., incorporated to take over the heating and plumbing business of E. V. Lombard, at 104 Lyon avenue. President, E. V. Lombard; vice-president, F. A. Lombard; treasurer, Walter Foote; secretary, Haakon A. Hagenson.

Lane-Pyke-Werkhoff Co., Lafayette, Ind., is the title of a new heating and plumbing firm, incorporated at $10,000, to take over the interests of Abner E. Werkhoff and Lane & Pyke. Both concerns have been in business in Lafayette for many years

Your Choice of Seven Types
is offered in our line of
Standard Recording Thermometers
We make a specialty of hot water and steam indicators
Send for Catalogue VH
Standard Thermometer Co., Clifton and Shirley Sts., Boston, Mass.

THE ⌐¬ SHAPE TUBES EXPLAIN THE SUCCESS
of the
PATTERSON HOT WATER TANK

for heating water for domestic or manufacturing purposes. Both ends of each seamless brass tube are expanded into heavy cast-iron tube-heads with an improved roller expander. Their shape provides for the free contraction and expansion of each individual tube without straining, so there is no danger of leakage.

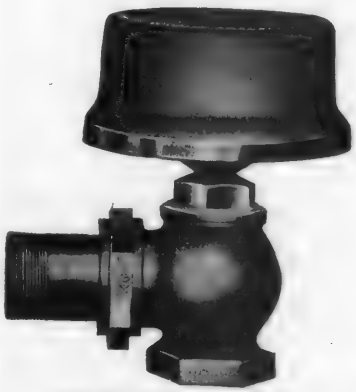


Type C. Patented Aug. 26, 1913.

Any Combination of Storage and Heating Capacities Can be Furnished.
Send for Catalogue.

FRANK PATTERSON & CO., 26 Cortlandt Street, New York
Representatives in all Principal Cities

The stability of the Johnson Service Company, and the exclusive merits of the Johnson System offer you the greatest value in temperature regulation.



The indestructible sylphon metal diaphragm valve

The Johnson Service Company is the pioneer manufacturer of temperature regulation system. The stability and responsibility of the Company are established by years of big successful business, the superiority of the Johnson System is demonstrated by hundreds of installations in high-grade school buildings, office buildings, apartments and residences. It is the Johnson System that has made temperature regulation a standard equipment for high-grade buildings.

JOHNSON SYSTEM
of TEMPERATURE REGULATION

—automatically maintains a uniform temperature and effects fuel economy—insures the consistent comfort absolutely essential to efficient school work.

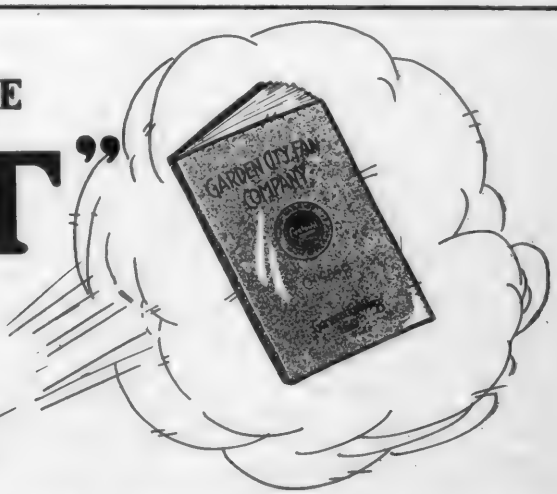
JOHNSON SERVICE COMPANY
New York Chicago Milwaukee, Wis.

THIS BOOK HAS MADE

"A HIT"

With Hundreds of Engineers, Architects and Contractors.

It's FREE for the asking



It's Our New No. 160 Complete General Catalog and Engineering Data Book. Covers Everything in the Fan and Blower Line. It's a Help to Anyone Estimating or Laying Out Fan Systems. Concise and Reliable.

GARDEN CITY FAN CO.
Established 1879 **CHICAGO, ILL.**

L. J. Wing Mfg. Co.
352 W. 13th Street
New York City

H. Mishler Co.
Penobscot Bldg.
Detroit, Mich.

and have executed many important contracts throughout the state. The quarters formerly occupied by Mr. Werkhoff have been taken by the new company. The officers are: President, Charles C. Pyke; vice-president, Abner E. Werkhoff; secretary, Warren Lane; treasurer, Eugene E. Clapper; superintendent, Charles Thoenes.

Gschwind Furnace Co., Youngstown, O., capital $250,000, to carry on the business of this company in the manufacture of warm-air furnaces, ventilators and other products. Incorporators: Carl E. Gschwind, Charles F. Ritter, Walter G. Scott, R. W. Archer and Dwight Harrison. W. W. Watson has been elected president of the company; Carl E. Gschwind, first vice-president; Col. C. F. Ritter, second vice-president; John J. Gorder, secretary and treasurer, and Dwight Harrison, general counsel. The company is planning to build a new plant in Youngstown, to occupy a site 60x200 ft., and to be two stories high, of concrete.

New Firms and Business Changes.

St. Albans Plumbing & Heating Co., St. Albans, Vt., announces that Lewis G. Irwin has become a member of the firm and will be associated with George H. Hersey. Mr. Irwin was formerly senior partner of Irwin & Hall of Swanton, heating and plumbing contractors.

York & Heilman, Pekin, Ill., is a new partnership of heating and plumbing contractors, composed of Fred York and George A. Heilman. Mr. York was formerly a member of the firm of York & Kraft, which was recently dissolved. The new company's quarters are at 225 Court Street.

Mayer & Donnelly, Cleveland, O., is the title of a new engineering firm composed of R. S. Mayer, representative of the C. A. Dunham Company, and D. B. Donnelly, formerly mechanical superintendent of the Leader News in Cleveland.

Knowles Plumbing & Heating Co., Champaign, Ill., has been formed by Charles H. Knowles, who purchased the interests and stock of the Carson-Payson Company. Mr. Knowles is a graduate of the University of Illinois and was for several years with the Carson-Payson Co., first as superintendent and later as manager.

John S. Jung, Milwaukee, Wis., has started in the heating and ventilating contracting business at 1010 Greenfield Avenue.

Augusta Plumbing & Heating Co., Staunton, Va., has been formed by F. N. Moran, formerly a partner with W. D. Runnels in the firm of Moran & Runnels. Mr. Moran

ACCURATE SERVICE

That is the strong point with Mueller Reducing and Regulating Valves. They never fail to yield it when they have been properly installed.

13160

If you are troubled by some perplexing pressure problem take the question up with us. In the Mueller line there is certain to be found just the valve you want.

There is no better all around valve made than the 13160. It's good on steam, water, air, oil, etc. Ask for our No. 5 Regulator Catalogue.

H. Mueller Mfg. Co.

Decatur, Ill.

145 W. 30th St. **589 Mission St.**
New York **San Francisco**

Davis Pressure Regulators Save Steam

DAVIS

When economy suggests or necessity demands the use of steam at less than boiler pressure use A DAVIS REDUCING VALVE.

This automatic device saves steam by delivering the exact amount required and no more. Being simple in construction and positive in action you may rely upon it for efficient service.

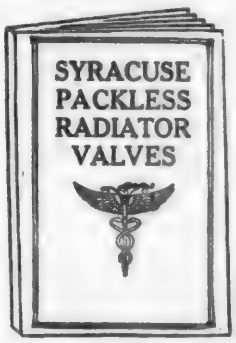
For forty years Davis Valves have been used by men of experience who demand the best possible results from their equipment.

G. M. DAVIS REGULATOR CO.
436 MILWAUKEE AVENUE CHICAGO
New York Boston Philadelphia Pittsburgh San Francisco

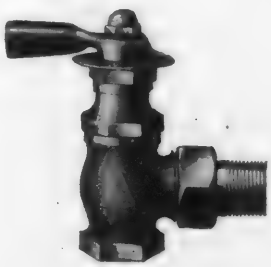
Send for Complete Catalog No. 8

VALVES

THREE NEW ONES



Catalogue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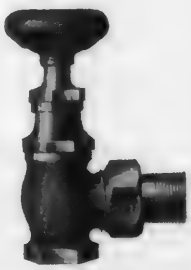

Style 38

ALL OF THEM DANDIES!

Send for the catalogue which tells about these new style valves.

SYRACUSE FAUCET AND VALVE COMPANY

Office and Factory
Syracuse, N. Y.

Sweet's Catalogue Page 1094
GEO. A. WELD CO., 79 Milk Street, Boston

220-224 West 42nd St.
New York City

is conducting the new company on his own account, although Mr. Runnels is still associated with him.

Contracts Awarded.

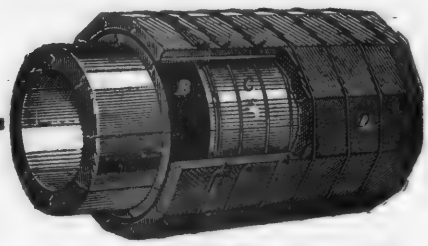
Western Heating Co., Los Angeles, Cal., heating and ventilating the new high school building in Los Angeles, for $28,628; the plumbing contract went to Arthur Hess, Los Angeles, at his bid of $22,548.

Nashville, Tenn.—Heating and ventilating bids were received as follows for the Hume-Fogg High School, in Nashville; Peters-Eichler Heating Co., St. Louis, $38,965; F A. Clegg & Co., Louisville, $43,600; T. J. Mooney Co., $44,376; Fitzpatrick & Hefferman, St. Louis, $44,377; Nashville Machine Co., $44,419; Standard Engineering Co., $45,200. The lowest bid for the plumbing work was $14,314, received from the East Side Plumbing Co.

Eckart Plumbing & Heating Co., Seattle, Wash., heating and ventilating the Lowell School in Seattle, for $7,985. The plumbing contract went to A. Whipple & Co., Seattle, at their bid of $6,950. The various bids received were as follows: Heating and ventilating, Eckart Plumbing & Heating Co., $7,985; plumbing, $7,251; D. H. King, heating and ventilating $8,177, plumbing $7,343; P. J. Lavan, heating and ventilating, $8,349; Musgrave & Blake, heating and ventilating, $8,555, plumbing, $7,858; Norton & Smith, heating and ventilating, $9,255, plumbing, $6,974; Rautman Plumbing & Heating Co., heating and ventilating, $9,389, plumbing, $7,000; J. A. Scherer, heating and ventilating, $8,725, plumbing, $7,388; Wenzler & Ward, heating and ventilating, $9,640, plumbing, $7,826; West Coast Heating Co., heating and ventilating, $8,955; W. D. Allen, heating and ventilating, $8,897; A. Whipple & Co., plumbing, $6,950.

Tacoma, Wash.—Bids were received as follows for the heating and plumbing work in the $75,000 Stadium High School Building, in Tacoma: W. B. Coffey Plumbing Co., heating $8,270, plumbing $7,597; Ben Olson Co., heating $7,788, plumbing $7,526; C. A. Richardson, heating $7,898, plumbing $7,605; A. Gehri & Co., heating $8,223, plumbing $7,384; Appling-Griggs Co., heating $8,000, plumbing $7,635, all of Tacoma. Other bids were received for the plumbing alone.

Orr & Graves Co., Sioux City, Ia., heating and plumbing public school building in Sloan for $10,000; heating and plumbing First Methodist Church in Sioux City, for $7,000; and heating freight depot of the Chicago and Northwestern Railway at Sioux City, for $6,000.



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes

WITH WYCKOFF'S IMPROVED

CYPRESS COVERING

Made of Gulf Cypress, the wood eternal

Not affected by wet and dry conditions common to steam-pipe trenches. Will not rot. Lasts twice as long as Pine Casing. Absolutely water and steam tight. Each shell is wound with heavy galvanized wire. Coated all over with the best known preservative—Hydrolene B.

Let us answer your questions and tell you all about it. Booklet on request.

A. WYCKOFF & SON COMPANY

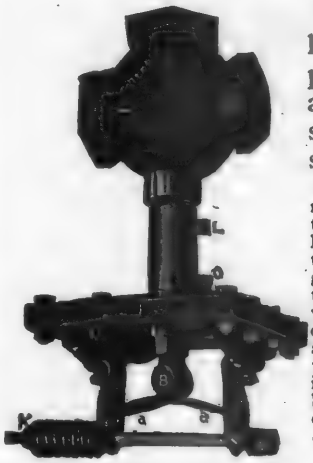
ELMIRA . . N. Y.

Chicago, Ill., 551 West 14th Place
Pittsburgh, Pa., Johnson-Peter Co.
Pittsburgh Terminal Warehouse

For Safety, Sureness of Operation and Durability

FOSTER PRESSURE REGULATORS

FOR STEAM HEATING SERVICE



(Classes "Q" and "Q H") lead the way. Designed especially for steam heating, and suitable for vacuum systems, for delivery pressure of from 1 to 15 lbs.

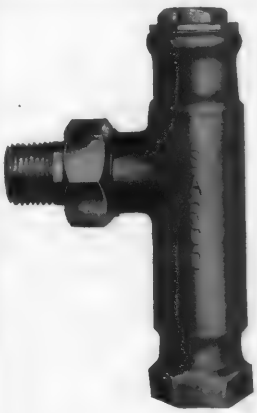
We make several types of pressure regulators—those shown in the illustrations here were designed particularly for steam heating service, and they are very sensitive, reliable, high grade in every particular and superior to other makes in construction and workmanship. There are no weights or close fitting pistons, and are easily adjusted to the desired pressure between 1 and 15 lbs. Made in sizes ¼ inch to 2 inches inclusive, composition body. Larger sizes are fitted with composition renewable seats.

Class "Q" Class "Q H"

These Valves are fully explained on Pages 29 to 33 of our General Catalogue, No. 20.

FOSTER ENGINEERING CO., Newark, N. J.

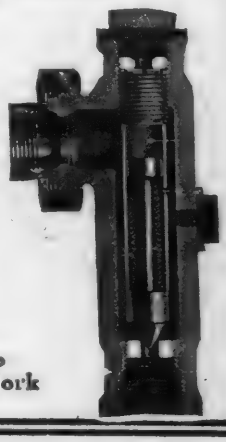
CHICAGO, ILL., 189 North Dearborn Street
PITTSBURGH, PA., 518 Park Building
PHILADELPHIA, PA., 601 Harrison Building
BOSTON, MASS., 161 Summer Street



Radiator Trap
SARCO

Two Pipe Low Pressure — Vapor —Vacuum Heating Systems

Principle—Thermostatic
Motive Power—Liquid Expansion and Contraction



Positively noiseless in operation. No place for scale and dirt to lodge. Contact between head of valve and seat a line instead of surface. Distance inlet to outlet 3″ or 1¾″ and can be installed at any angle. Guaranteed not to stick or air bind. You cannot buy a more accurate Radiator Trap no matter how much more you pay for it.

Send today for list and trial offer

SARCO COMPANY, Inc., Old Colony Bldg., Chicago
South Ferry Bldg., New York

Business Chances.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the following named work:

Until May 15, 1916, for the construction complete of the U. S. Post Office and Custom House at Newport, R. I.

Until May 17, 1916, for the construction complete of the U. S. Post Office at Little Falls, Minn.

Until May 18, 1916, for the construction of the U. S. Post Office at Durango, Colo.

Until May 19, 1916, for the construction complete of the U. S. Post Office at Wenatchee, Wash.

Until June 5, 1916, for the construction of the U. S. post office at Belton, Tex.

Until June 6, 1916, for the construction of the U. S. post office at Waynesville, N. C.

WANTED.

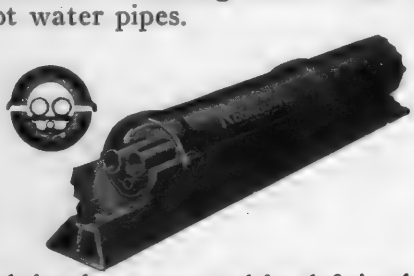
Position Wanted.—By experienced heating engineer. Can design, estimate and install any size job. At best in supervising large installations. Can handle men and knows the business from the ground up. Can give excellent references. Address K, care of HEATING AND VENTILATING MAGAZINE.

THE LOW COST

of installation and the almost total absence of maintenance expense make the

RIC-WIL METHOD

the choice of the great majority of engineers, architects and contractors who have had occasion to study the insulation of **underground** steam and hot water pipes.



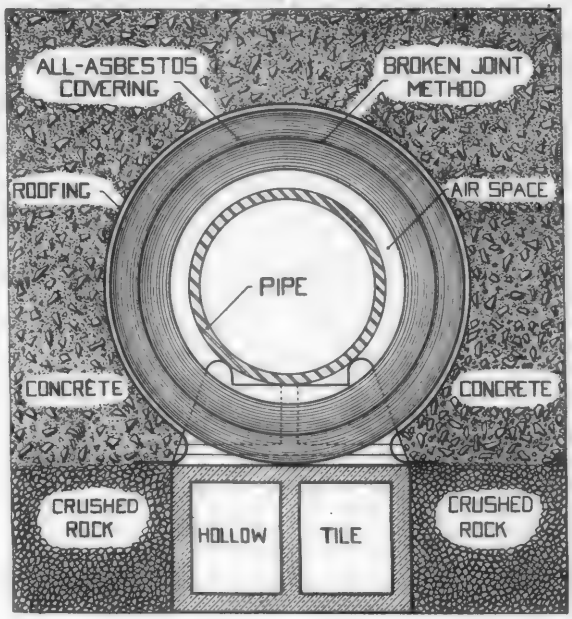
Ask for the reasons and for definite data on any specific class of work.

THE RIC-WIL COMPANY
623 New England Building
Cleveland, Ohio

Pyro-Bestos Underground Pipe Insulation

For piping from central heating or power station to detached buildings of Universities, Asylums, Hospitals, Factories, etc. Also as underground Pipe Conduit for heating private Auto garages direct from House heating system. Lasts longer than Wood; in fact indefinitely. Easily applied and of reasonable cost. Is water repellant—does not absorb moisture like Magnesia, Infusorial Earth or the loose filling in Tile Conduit systems, all of which materials acting like a wet sponge held against the piping soon rust holes in the piping. We have cases on record where Insulations of the absorbent type have totally destroyed the piping in five years and less after installation, making it necessary to go all over again with the cost of digging trenches, new piping and new Insulation. No material of an absorbent nature should be placed around underground piping. Test all underground Insulations offered you by placing a fragment in a glass of water. If it absorbs water, don't use it.

National Air Cell Covering Co.
210-220 Van Brunt St., Brooklyn, N. Y.



A type of Heating Mains with few specials—easily installed—permanent

INDESTRUCTIBLE

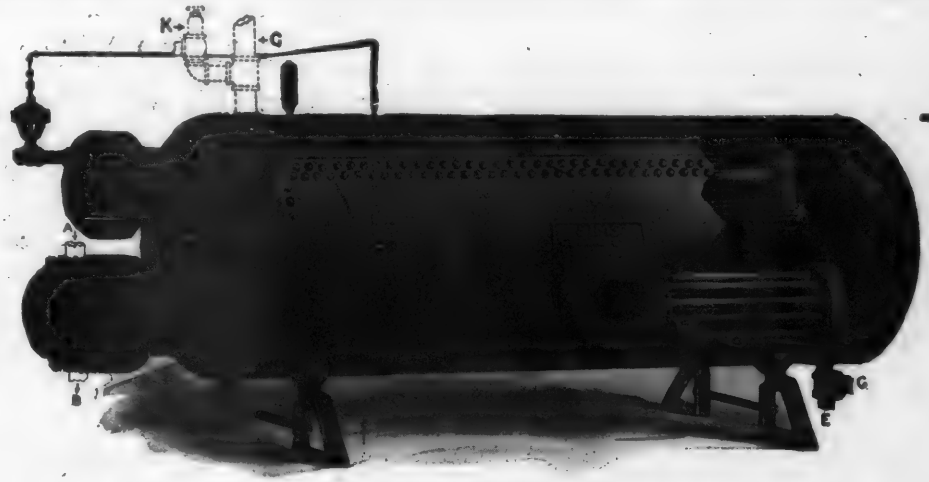
Conduit is made of CONCRETE and every LOCALITY "has the MAKIN'S"

Let me furnish you the covering, expansion joints, etc., together with complete specifications to meet your case.

Ask for quotations or estimates.

J. C. Hornung, Engr.

111 West Monroe Street
Chicago



WHEN THE HOT WATER DEMAND RUNS HIGH

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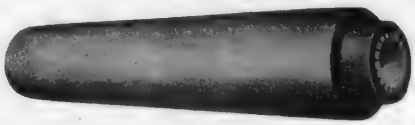

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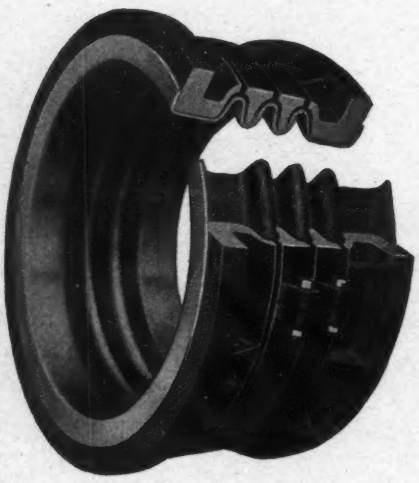

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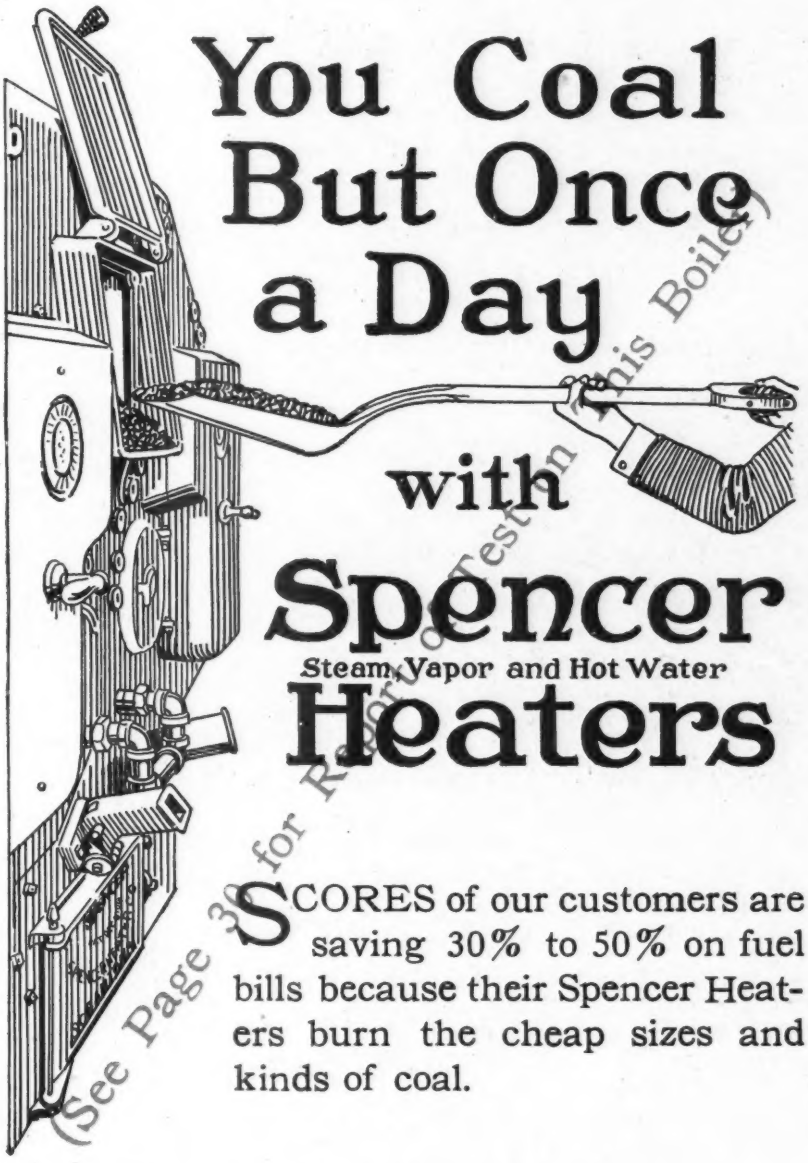

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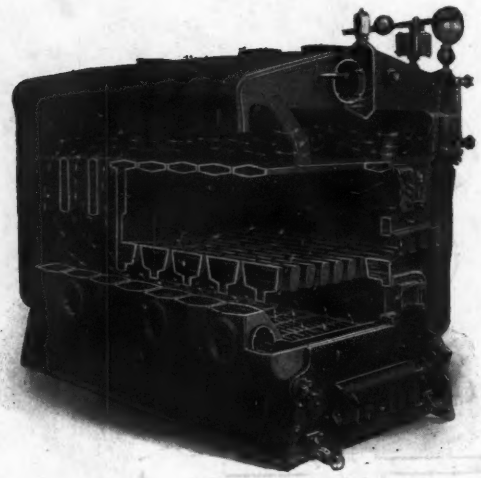

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